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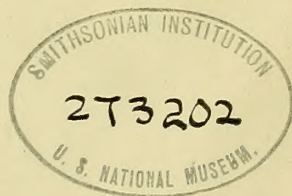
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THE AUSTRALIAN ZOOLOGIST

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The Royal Zoological Society of New South Wales

WITH FORTY-FIVE PLATES,
And Sixteen Text-figures.

Vol. 2.—1921-1922.



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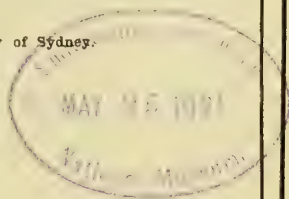
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Royal Zoological Society of New South Wales.

Established 1879.

REGISTERED UNDER THE COMPANIES ACT, 1899 (1917).

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"THE AUSTRALIAN ZOOLOGIST."

Communications intended for "The Australian Zoologist" should preferably be type-written.

Authors should state whether proofs and reprints are desired when submitting MS. Fifty reprints of any article appearing under a separate title will be supplied gratis. If more are required, terms may be ascertained on application to the Editor.

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Royal Zoological Society of New South Wales.

ANNUAL REPORT

OF THE

ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES
1919-20.

The third annual general meeting of the Society was held at Taronga Zoological Gardens on Saturday, 31st July, 1920, at 3 p.m.

Thirty members and five visitors were present.

The President (Mr. W. W. Froggatt, F.L.S., F.E.S.) read the following report:—

The past year has been one of steady progress, marked by a satisfactory increase in the membership, and the invested capital of the Society; while a gratifying beginning has been made in the building up of the Handbook Publication Fund.

Membership.

On 30th June, 1919, the membership roll contained the names of 221 ordinary, 6 honorary, and 17 associate members, a total of 244. On 30th June, 1920, the numbers were:—260 ordinary, 7 honorary, and 28 associate members, a total of 295, being an increase of 51. One honorary member, and 6 ordinary members were lost by death, 5 ordinary members resigned, and 8 failed to renew their membership.

The Council.

Nine meetings of Council were held during the year, the attendances at which were as follows:—Messrs. Finckh, Hull and Waterhouse, 9; Messrs. Campbell, and McCulloch, 8; Mr. Shipway, 7; Messrs. Hedley, Halloran, Froggatt and Dr. D'Ombraim, 6; Mr. Symons, Professor Johnston and Mr. Harrison, 4; Col. Spain, 3; Dr. Tillyard and Dr. Ferguson, 2.

Finances.

The Capital Fund, which on 30th June, 1919, existed as a nucleus of £56 only, now stands at £345 5s. £81 19s. 2d. is carried to the credit of the General Account, and the Handbook Publication Fund stands at £268 5s. 8d. The satisfactory condition of our funds must be a matter for congratulation, but our two objectives are still far from attainment, although the first—the Handbook Fund, is within measurable distance of the goal.

Australian Zoological Handbooks.

It was intended to make a commencement by publishing Mr. McCulloch's "Fishes of New South Wales" in sections in the "Australian Zoologist," but the work is now so far advanced towards completion in manuscript that it is proposed to issue it in one separate volume. Mr. Waterhouse has a work on the Butterflies in a forward state of progress, and this may possibly be published during the current year.

The Australian Zoologist.

Only one number of this journal was issued during the past year, but another was completed, its issue being delayed owing to changes in the editorship and the printers.

PRESIDENTIAL ADDRESS.

A BUREAU OF BIOLOGICAL SURVEY.

Walter W. Froggatt, F.L.S.

The question of establishing a Bureau of Biological Survey or a Bureau of Economic Zoology is one that should appeal to all good Australians. In our great island continent we have what we might call a prehistoric fauna, the living representatives of the earlier types of mammals and other creatures which once populated the whole of the earth's surface.

Ages ago they vanished from the old world, where evolution has produced the present fauna, and the marsupials and monotremes are only represented by their fragmentary remains in the fossiliferous rocks. Into such a fauna, unaltered throughout ages of isolation, we can imagine what a change in the balance of nature could be wrought by man, with his accompaniment of the more highly developed forms of life.

Two great factors which were conducive to that stationary existence of our prehistoric fauna here were, first, the early disappearance of the large marsupial carnivora, *Thylacoleo carnifex*, and *Sarcophilus prior*; and, secondly, the only modern advent of our aboriginals, who, too, made no appreciable alteration. The aboriginals were not cultivators, maybe on account of the arid conditions of our continent which faced the original founders who landed on our northern coast. This trait prevented them from becoming a big population.

Despite the prophecies of our naturalists of fifty years ago—Dr. Bennett, Gould, and others—that all our large kangaroos, emus, and other large birds would be extinct in a few years, we find that, up to the present time, there has been little danger of the kangaroos and other animals and birds that range over the whole of Australia becoming extinct when afforded adequate protection.

In the west, away from the railway lines, kangaroos and emus are still plentiful, too plentiful the station owners claim. We frequently read reports from Pastures Protection Boards, asking that the local protection of marsupials be lifted for a month or more on account of the excessive increase of kangaroos. At Yarrawin, near Brewarrina, the men mustering in one of the paddocks near the Government Sheep Fly Experiment Station, in the summer of 1914, found 48 emu nests, and they were nesting also all over the run.

Aboriginals, the dingo, and periodical droughts were the natural checks. When the natives vanished, and when the dingos were hunted and poisoned, and when the survivors found lambs much easier to catch than kangaroos, such numbers of kangaroos appeared that a Marsupial Bill was brought into force in Queensland. In the last decade these conditions have again altered. Fresh settlement is pushing out on all sides toward the centre of Australia, and new and improved methods of destruction now threaten our unique fauna.

The subdivision of the land with wire-netted fences and rabbit-pit traps cause the death of scores of porcupine anteaters (*Echidna*). I have seen a dozen of these harmless creatures killed at one trap on the Barwon River; and between two

lagoons I have found fifty mud turtles dead along a wire-netted fence between them and the river.

Other methods adopted for the destruction of the rabbits are affecting the animals and birds of the west. The introduced fox is extending his range all over the continent, and all ground nesting birds and animals are at his mercy. Introduced starlings and sparrows are appearing in immense flocks, and are not only eating up the food of our useful native birds, but occupying their nesting places.

Last, but not least, the value of the furs and skins of our marsupials, and the feathers of our birds is increasing every year, leading to the wholesale destruction of many species. Again, there is the motor boat used in the capture of wild fowl. I have known of "sportsmen" with motor boats running down and drowning the moulting black swans for sport!

The motor car can outstrip the swiftest kangaroo or emu on the big plains and is now often used for kangaroo hunting, when the hunted has not a sporting chance of escape.

Much of the destruction of wild life is unavoidable when we drain the swamps and clear away the scrub and forest, if we are going to get the best returns for our crops, and flocks and herds; but much could be avoided, and a great national asset could be created under a scientific protection of our wonderful and prolific native life. We have in our "Birds and Animals Protection Act, 1918," one of the very best wild life protection Acts ever passed into law in Australia. This Act was drafted and discussed by economic zoologists who knew what they were doing; and though some of their suggestions were ruled out in Parliament, it is still far ahead of any Act previously passed.

One of the strong points in the 1918 Act was the black-listing of only noxious birds and animals; and a complete or partial protection of every other bird and animal not specified in these two schedules. Yet in a Supplement of the Government Gazette, January 8, 1919, upon whose authority I know not, a number of rare hawks have been added to the black-list of outlaws. Modern investigations regarding the feeding habits of hawks and owls have shown that the little damage they do to game and the poultry yard is more than balanced by the number of noxious insects, mice, and small reptiles they destroy.

The rarity and beauty of several of these birds would alone have kept them out of the black list if the authorities had consulted an economic zoologist.

I also claim, and I think with sound reason, that such useful carrion and insect-eating birds as the crows, other similar birds, and our great eagle, should only be proclaimed outlaws where they are attacking the ewes and lambs, and that in other districts they should have the protection of the Act.

In most of the United States all Scalp Acts have been repealed except those against the pestiferous English sparrow. The fauna of Australia has been greatly neglected from a commercial standpoint. Our Game Acts and Wild Life Protection Laws are at the present time a great improvement upon those in existence twenty-five years ago; yet the State is not getting the best value for its wild animals and birds that are slaughtered and sold by hunters for their food value, their skins, their fur or their feathers. Our wild life has been the subject of much legislation, and the definition of game has varied considerably in the successive game laws of all our States.

In the Old World it has been much the same; but there, where so many interests are involved, united action has been difficult, particularly where the armies of migratory birds fly annually over half a dozen kingdoms.

Previous to the war, the ornithologists of the countries of Central Europe protested against the wholesale slaughter of the game and insectivorous birds as they rested on the shores of the Mediterranean after their long flight homeward from the south, and a number of International conferences had been held in Hungary, Austria, and Russia. On the 19th November, 1913, the International Conference for the Global Protection of Nature was held at Berne, Switzerland, when 19 countries were represented.

Among them the Australian Commonwealth was represented by Mr. F. J. E. Carroll, and Victoria by Mr. McBride. The Hon. C. N. Rothschild appeared for Great Britain. An Acte de Fondation was issued and signed by those present. Beside the more deeply interested European delegates, two representatives were nominated for all the self-governing colonies. I had the honour, with my friend Mr. J. H. Maiden, to be nominated to represent Australia.

The next meeting to which we were invited was to have taken place in Vienna in 1915, but was abandoned on account of the outbreak of war. The subjects to have been discussed were as follow:—

- (1) The Preservation of the Birds of Passage.
- (2) The Preservation of Warm-blooded Sea Animals, Whales, Seals, and in connection with the Whaling Industry of Norway.
- (3) The abolition of the use of poison in the destruction of carnivorous animals.
- (4) Trading in the feathers and skins of birds for millinery purposes.
- (5) The preservation of the fauna of Spitzbergen.
- (6) The Russian and Canadian Governments to be urged to protect the Musk Ox.

The question of another meeting of this International Conference was mooted last year; but as the European States concerned were in such a disorganised condition and several of the enemies delegates were included in the list, the whole question will have to be reorganised.

Canada and the United States only came to an understanding last year in regard to the treatment of the migratory birds common to both countries. The International Convention in 1916 between Great Britain and the United States has been effective in the passing of the "Migratory Birds Convention Act." This treaty was signed in Washington on August 16th, 1916, and was ratified by the Senate of the United States a few weeks later. This International Act affects the lives of 1000 species and sub-species of North American birds that range from the Arctic regions to the Gulf of Mexico.

As in Australia, much experimental legislation had been enforced by the United States in their endeavour to save their native fauna. Their difficulties were greater than ours; for until quite modern times not only had every one of the fifty individual States and territories their own State game laws, but many of the counties of some States had their own local game Acts; so that a poacher could step over the border of an adjoining county or a State and defy the game warden with impunity.

The importance of the relation of birds to agriculture was proved by the investigations carried out by the American Ornithologists' Union, and led to Congress granting on July 1st, 1885, an appropriation of 5000 dollars, to be expended under the direction of the Federal Division of Entomology.

Dr. D. C. Merriam, the well-known zoologist, was placed in charge of this work, and in the following year it was given separate rank as the Division of Biological Survey when the importance of the work was recognised.

The original lines of investigation were as follow:—

- (1) To determine the food of birds of economic importance.
- (2) To act as a court of appeal regarding birds charged with damaging crops.
- (3) To diffuse the result of this work and to educate the public up to the value of birds.

Later Federal legislation took up the question of uniform game laws; and several Acts were passed dealing with the whole of the United States. The three most important were known as the Hoar Bill, the Teller Bill, and the Lacey Bill. The first dealt with the protection of song birds, and was introduced by the Hon. G. F. Hoar, of Massachusetts, in March, 1898, and became law the following year. It was entitled "The Bill for the Protection of Song Birds." This Bill did not pass Congress until 1899. As this legislation was aimed directly against the feather trade, it met with considerable opposition from those interested in the business.

The next Federal Game Act was introduced by Senator Teller in 1899; the Teller Bill aimed at regulating the traffic and shipment of wild game from one State to another.

The third and most important Bill passed by the Senate was that brought in by the Hon. J. L. Lacey, and which finally became law in May, 1900. "An Act to enlarge the powers of the Department of Agriculture, prohibit the transportation by interstate commerce of game killed in violation of local laws, and for other purposes." Two of the main clauses were those dealing with the restocking of areas where birds and animals had been exterminated, and the power to stop the importation of foreign birds and animals that could become serious pests. As in other parts of the world, these Federal laws came into force too late to save many rare birds; but under existing conditions, with the educational propaganda that is being spread throughout the United States, with the appointment of game wardens to enforce these Acts, and with the limiting of the number of game birds and animals that every hunter or hunting party can shoot under the terms of the licence to them, a great difference is being made in the security of wild life in North America.

Great Britain has not been behindhand in trying to stop the lawless and wasteful destruction of wild life in lands under her protection. In Uganda, East Africa—one of the last homes of the big game of Africa—stringent laws have been enacted, and graduated licences issued to the Imperial officers, the natives, and shooting parties from other countries.

The Plumage Act passed by the British Government, entitled "The Importation of Plumage (Prohibition) Act, 1913," which came into force on the first day of January, 1914, met with much opposition in 1909 from the London Chamber of Commerce, and was criticised by the Board of Trade, the members declaring that instead of stopping the wholesale slaughter of plumage birds of British-India, it would only destroy the great feather trade of London, and drive it to the Continent.

In a proclamation dated 17th of March, 1911, our Commonwealth Customs prohibited the importation of the plumage and skins of fourteen groups of birds, among them the Birds of Paradise and the Gouras or Crowned Pigeons of Papua. This proclamation made much more effective an ordinance in force in Papua: "To consolidate and amend the laws relating to the protection and collection of birds," May 16th, 1911.

A treaty for the preservation and protection of the fur seals which frequent the waters of the North Pacific Ocean was signed at Washington on July 7, 1911,

by delegates from the United Kingdom, the United States, Russia and Japan. All these contracting Governments agreed to take measures to see that proper protection was enforced and the convention was to last for fifteen years from the 15th December, 1911.

The value of insectivorous birds is a matter quite beyond dispute. We know, however, very little of the individual value of most of our birds. Our Department of Agriculture has published a Science Bulletin, No. 15, "The Food of Australian Birds, an investigation into the character of the Stomach and Crop Contents." It is valuable as far as it goes; but many of the birds the stomachs of which were examined were shot about gardens and homesteads at all hours of the day. They should have been shot in their native haunts in the early morning, when their food was fresh and undigested.

A Bureau such as I advocate would deal with the value of insectivorous birds from all points of view, but there are many other important questions that would also come under their control. Among them, as subjects for investigation it would outline the following:—

The Commercial Value of Game Birds.—From a national standpoint this is one of the most valuable, for we should be able to promote the building up of a large supply of food.

The food value of game birds, wild ducks, wild geese, bustards, swans, plover, quail, and snipe, has never been considered by our legislators. Under proper regulations our wild game could be as plentiful upon our table during the open season as fish, and would realise a large revenue to our States. A royalty upon all game shot or a gun tax for all persons who shoot for pleasure or profit, would not affect the man on the land, and would bring in revenue sufficient to pay the salaries of game wardens or rangers, whose duties would be to see that our so-called sanctuaries were real homes for the wild game, and to prosecute all poachers.

We have in all our States large tracts of public and private land, forest, lakes, swamps and coastal estuaries that have been proclaimed sanctuaries. In a Supplement of the Government Gazette, "Birds and Animals Protection Act, 1918" (January, 1919), the definition of the proclaimed sanctuaries covers two pages. These are, however, under present conditions, only sanctuaries in name; they are without direct supervision, and any poacher can enter and shoot with little fear of detection.

The Marsupial Skin and Fur Trade.—The enormous value of the skins, and furs of our kangaroos, opossums, and other marsupials can only be realised by studying the trade returns as issued by our home and foreign sellers. The fecundity of all our marsupials is something marvellous, for in a land of almost perpetual summer and normal food conditions they breed the whole year round. Instead of being a pest, under proper regulation such as the deer in California are treated, they should bring in a large revenue to the Treasury. Their skins and furs bring in many thousands of pounds annually; but who gets the money? Should not the State get some royalty on the wild game which does not belong to the individual but to the State as a whole?

On the last list of Furred Skins Sales issued in Dalgety's Weekly, opossum skins, first blue, are quoted at 125 shillings a dozen; second quality 90 shillings, and third quality 70 shillings per dozen. At one of the recent fur sales in St. Louis, U.S.A., some of our opossum skins brought 30 shillings each at auction. Large kangaroo skins brought from 90 to 124 pence each, wallaroos from 40 to 70 pence each, swamp wallaby 35 pence, and scrub wallabies from 15 to 20 pence each.

At the present time the opossum skin fur is one of the most sought after in the world; and the opossum poacher runs many risks to get skins. Under scientific protection as instanced at the Wilson's Promontory Sanctuary, Victoria, one of the few places as yet where it has been carried out, the opossums have increased in such numbers as to become almost a menace to their food plants.

An opossum farm, at the present values, should pay almost as well as a sheep station, if the promoters could be protected against poachers and guaranteed rights over suitable forest areas.

The demand for fur skins is not diminishing in the least, while the supply is lessening all the time. The great Russian supplies will take years to get back to former proportion, and the fur trappers of North America are being driven further north into the Arctic regions every year. Under the Queensland Act, opossums and native bears are protected from November 1st to April 30th in the following year, but the period is often altered. This year the open season was from 1st April to the 31st July. Native bears have been protected the whole of this year. The fee for a trapper's licence for opossums and native bears is 5/ per annum. I am informed on good authority that there has been an immense slaughter of opossums in Southern Queensland this last open season, men easily making £10 a week shooting opossums.

The Field Investigation of the Mouse and Rat Plagues. The enormous swarms of mice that appear in our south-western country and cause such damage to wheat are worthy of careful study, and there is no reason, if united action was taken under proper direction, that they could not be checked and destroyed before they came into the wheat areas. Two years ago they were the cause of the loss of over a million pounds' worth of wheat at the very lowest estimate. Plagues of native rats and mice in a more limited way often appear in the same manner travelling eastward. Though so numerous we know little or nothing of their habits, range or food supplies.

The Study of Introduced Birds and Animals. Through the neglect of ordinary precautions we have in times gone by allowed a number of birds and animals to be introduced from foreign countries. These, without the natural checks that controlled their undue increase in their native lands, have spread far and wide in Australia, and are now serious pests. Leaving the rabbit out of the question, we have the fox, the starling, and the sparrows, all taking toll of our agricultural and pastoral products.

Power to Stop the Introduction of other Foreign Birds, Animals, or other Creatures. We have had a number of suggestions during the last ten years for further interference with our fauna. One resident of South Africa approached the pastoralists some years ago with a proposal to introduce the Red Meat Ant, *Dorylus helvius*, from that country into Australia to kill out the rabbits. On inquiry, I found that the ant in question was a regular household pest in its native land. It was seriously proposed to introduce the eland and turn it adrift in the Australian bush. Within the last few years suggestions have been made to introduce American and African carrion-eating birds to fight the blowfly pest.

The Migration of Birds. As in other parts of the world, many of our native birds are migratory, returning from the south to the north as winter approaches, following the summer and their food supplies, and returning from the north the following spring. Some have the popular name of "summer birds" on account of this habit. There is much valuable information to be tabulated about their movements and breeding habits if they were under trained observation.

Uniform State Laws. The illicit destruction of protected animals and birds can only be checked by uniform laws in all our States.

At the present time we have in the Commonwealth many laws and regulations, as well as sanctuaries, quite sufficient to protect and allow our wild game to increase and multiply without any danger of extinction, but we have no machinery to enforce these laws, and there are no appointed rangers to look after the sanctuaries.

In New South Wales the Game and Wild Birds Protection Acts are administered from the Colonial Secretary's Office by the police. In any district where game or furs and skins are obtainable, the hunters will naturally study the habits of the local policeman; and also, where there is an open season in an adjoining State they have no difficulty of disposing of their skins at the present prices, in spite of the close season in New South Wales. The Dingo and Marsupial Destruction Act of 1918, Queensland, is carried out by members elected to the Marsupial Boards and a tax to pay the bonus on dingoes and marsupial scalps is levied upon all stockowners.

First we must have uniform laws between the States if we are going to stamp out the illicit trade in furs and skins. Secondly, we must have a qualified Commissioner, who is not only a practical zoologist, but is thoroughly acquainted with the country and with the conditions under which such laws can be enforced. We must have one who, without injustice to the land owners or country residents, would investigate every report of the undue increase of animals or birds, and would take measures to keep them from becoming a pest, and regulate the shooting when he considered the protection should be raised. He should be entitled to levy a royalty of 25 per cent. or even more upon the value of the skins and furs of animals thus destroyed, for all wild game is the property of the State.

Now, it is at the request of the members of the local Pastures Protection Board that the close season is lifted for a period of a month or more by the Colonial Secretary and then indiscriminate slaughter sets in, and it is a wonder that anything is left alive in the district when the period is up. These boards also offer bonuses for the scalps of animals or heads of birds considered noxious, with little or no knowledge of the value or otherwise of the so-called pest.

Granted that the Pastures Protection Boards are composed of the resident land owners of the district interested, their opinion, as judge and jury, on the value of any creature that is eating the grass and herbage which they consider would be better consumed by good merino sheep is liable to be prejudiced. Claiming that no individual has any right to the free wild game that passes over the land or nests and feeds upon it, we want to see the laws administered so that the State, while collecting enough money to place a game warden in every district shall receive a substantial addition to her revenue, and in open season a regular supply of game shall be obtainable to form a valuable addition to our food supplies.

ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES

BALANCE SHEET AT THE 30th JUNE, 1920.

| LIABILITIES. | | ASSETS. | |
|---|-----------|--|-----------|
| | £ s. d. | | £ s. d. |
| Capital | 345 5 0 | Investments in Government Securities | 345 5 0 |
| Handbook Fund | 268 5 8 | Government Savings Bank (Handbook A/c) .. | 268 5 8 |
| Income Account at 30th June, 1920 | 81 19 2 | Cash in Bank | 5 5 10 |
| | | Cash in Savings Bank (A/c) .. | 76 13 4 |
| | | | 81 19 2 |
| | £695 9 10 | | £695 9 10 |

RECEIPTS AND EXPENDITURE FOR YEAR ENDED 30th JUNE, 1920.

| RECEIPTS. | EXPENDITURE. |
|---------------------------------|-------------------------------------|
| | Publication— |
| £ s. d. | £ s. d. |
| Balance from 30th June, 1919 .. | <i>Australian Zoologist</i> — |
| Subscriptions .. | Printing .. |
| Do., Life .. | Blocks .. |
| Sales .. | Photographs .. |
| Interest .. | |
| Government Grant .. | Petty Cash and Expenses .. |
| Fines .. | Appropriation to Capital Account .. |
| | Balance to 1st July, 1920 .. |
| | |
| £454 11 0 | 128 14 11 |
| | 48 11 11 |
| | 195 5 0 |
| | 81 19 2 |
| | £454 11 0 |

HANDBOOK FUND ACCOUNT FOR YEAR ENDED 30th JUNE, 1920.

| RECEIPTS. | EXPENDITURE. |
|------------------------|----------------------------|
| | |
| £ s. d. | £ s. d. |
| Donations .. | Balance in Savings Bank .. |
| Sale of Butterflies .. | |
| Interest .. | |
| | |
| 114 19 0 | 268 5 8 |
| 150 0 0 | |
| 3 6 8 | |
| £268 5 8 | £268 5 8 |

Sydney, 23rd July, 1920.

G. A. WATERHOUSE, Hon. Treasurer.

We have examined the books and vouchers of the Society for the twelve months ended 30th June, 1920, and certify the above Statement of Receipts and Disbursements and Balance Sheet to be in accordance therewith.

Sydney, 26th July, 1920.

L. S. DRUMMOND & CO., Incorporated Accountants.

The Report and Balance Sheet were adopted.

Mr. L. Harrison, B.A., B.Sc., exhibited two species of Frog, briefly describing their habitats and sketching their life histories.

Mr. H. E. Finckh exhibited an aquarium, and discussed the advantages accruing to the owners of aquaria.

Mr. G. A. Waterhouse, B.Sc., B.E., exhibited specimens of a butterfly (Tisiphone) showing northern and southern parents which he had mated, obtaining five of their offspring.

The following members were elected to fill vacancies in the Council, in accordance with the provisions of Article 23:—Mr. J. H. Campbell, Dr. E. W. Ferguson, Mr. W. W. Froggatt, Mr. G. M. Goldfinch, Mr. L. Harrison, and Mr. A. Musgrave.

At a meeting of the Council held at the conclusion of the Annual General Meeting, the following officers for the year 1920-21 were elected:—

President, Dr. D'Ombraïn; Vice-presidents, Messrs. H. E. Finckh, W. W. Froggatt, S. T. D. Symons, and G. A. Waterhouse; Honorary Secretary, Mr. A. F. Basset Hull; Honorary Treasurer, Mr. G. A. Waterhouse; Honorary Editor, Mr. Launcelot Harrison; Honorary Librarian, Mr. H. E. Finckh.

NEW MEMBERS.—The following new members have been elected since the publication of the list in Vol. I., Part 8, of this journal:—

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NOTES ON SOME AUSTRALIAN SYRPHIDAE (DIPTERA).

By G. H. Hardy.

Plate 1.

The material dealt with in this paper covers all the sub-families known to occur in Australia, except the *Syrphinae*. The species are studied mostly from the writer's own collection, and specimens identified in other collections are recorded in the text.

Insufficient material is to hand for the purpose of making a satisfactory revision of the family, but some of the more important synonyms so far worked out are recorded here, and an attempt has been made to construct a workable key for such sub-families and genera as are known to the writer from Australia.

The writer is indebted to Mr. C. E. Cole for pointing out that *Microdon brachycerus* Knab and Malloch is a synonym of *M. vittatus* Macquart; and also that *M. daveyi* K. and M. is a synonym of *M. variegata* Walker. Specimens of the latter in Dr. E. W. Ferguson's collection, and examined by the writer, corroborate Mr. Cole's information.

Two species are described as new; one of these belongs to a sub-family in which no Australian species has previously been placed.

Key to the Australian Syrphidae.

- | | |
|---|-------------------------|
| 1. The antenna with dorsal arista | 2 |
| The antenna with a terminal style | <i>Ceriodinae</i> |
| 2. The intermediate cross vein situated before the middle of the discoidal cell | <i>Syrphinae</i> |
| The intermediate cross vein situated at or after the middle of the discoidal cell | 3. |
| 3. The cubital vein with a deep deflection encroaching upon the first posterior cell | <i>Eristalinae</i> 6. |
| The cubital vein without a deflection; sometimes a veinlet issues from the cubital vein into the first posterior cell | 4. |
| 4. The cubital vein with a veinlet branching into the first posterior cell | |
| The cubital vein simple, without a veinlet | <i>Microdentinae</i> 5. |
| 5. The antenna elongate, longer than the length of the head. | <i>Chrysotoxinae</i> . |
| The antenna short, shorter than the length of the head. | <i>Milesiinae</i> . 7. |

ERISTALINAE.

- | | |
|--|-----------------------|
| 6. The subcostal cell closed | <i>Eristalis</i> . |
| The subcostal cell open | <i>Orthoprosopa</i> . |

MILESIINAE.

7. The eyes hairy, the face not protuberant, the epistoma slightly convex.
The upper marginal cross-vein recurrent *Eumerus*.
The eyes bare, the face protuberant. The upper marginal cross-vein not
recurrent 8.
8. The hind femora with a series of spines on the under side . . . *Xylota*.
The hind femora without spines 9.
9. The epistoma deeply concave and with a very pronounced central knob.
The marginal cross-vein forming a broken line *Criorrhina*.
The epistoma less deeply concave. The marginal cross-veins forming an
almost unbroken line *Deinzeches*.

Sub-family CERIOIDINAE.

Note.—This sub-family contains one genus, *Ceriodes* Rondani, which name was created to take the place of the preoccupied *Ceria*, and in the genus three species have been described from Australia. There are four species in the Macleay Museum, but their respective identities are not quite certain.

Ceriodes australis Macquart is described from Tasmania, but the genus is not represented from that State in recent collections. It is described as having the first joint of the antennae as long as the scape, and except in *C. breviscapa* the antennae of those under examination have the first joint shorter.

Ceriodes breviscapa Saunders is represented by one specimen from South Australia and four from New South Wales. The scape, usually very long, is short and practically obsolete in this species.

Ceriodes ornata Saunders has the first segment of the abdomen only slightly constricted; in the other species examined the abdomen is strongly constricted at the base. Two species exhibit this abdominal character, and one of these has a pair of callosities on the second abdominal segment. It was found labelled under Saunders' name, and is represented by specimens from Queensland and New South Wales. The second species is without these callosities, and is represented from Queensland.

A further species of *Ceriodes* is represented from Queensland and New South Wales; the chief characters consist of a much constricted abdomen with the constricted portion much longer than in *C. breviscapa*; the cubital vein is deflected and encroaches very deeply into the first posterior cell, but the area within the deflected portion of the cubital vein is hyaline and not brownish like the remainder of the wing above the cubital vein.

Sub-family CHRYSOTOXINAE.

Genus *Chrysotoxum* Meigen.

Chrysotoxum bicinctum Linnaeus, known from Europe and North America, was erroneously recorded from Australia by Walker in 1849.

The species described below as new does not belong to this genus in its restricted sense, but is placed here until its position can be ascertained more satisfactorily.

Chrysotoxum elongatum sp. nov.

(Pl. 1, figs. 1 and 2.)

Description.—Male. The head is black and more or less semi-globular, broader than high and broader than the thorax, excavated behind. The eyes are

contiguous for a little distance, and are bare with slightly larger facets on the summit than elsewhere. The vertex is a little longer than the maximum width and almost entirely occupied by a black ocellar tubercle on and behind which there is a little yellow hair which extends behind the eyes. The antennae are inserted above the middle of the head, are elongate and porrect; the basal joint is long; the second joint is twice the length of the first; the third joint is a little shorter but broader than the second and bears an arista situated near the base; the basal joints are brown and have a few bristly hairs; and the third joint is black. The epistoma is somewhat convex, without a central knob but protrudes above the oral margin; the cheeks are very small. The face and antennal triangle are covered with a dense yellow tomentum and some thin yellow hairs. The protuberance above the oral margin and the area behind the oral cone to the rear of the head are black and shining. The proboscis is black.

The thorax is black, but shines slightly with metallic colours on the dorsum; it is covered with a short pubescence which is mostly yellow in colour and near the anterior border there is some white tomentum; ventrally the pubescence is whitish. The thorax is much longer than wide, and the wings are set at about two-thirds its length. The scutellum is similar in colour to the thorax but contains longer yellowish pubescence.

The abdomen is black, very long, tapering to the apex of the second segment, on which is situated a pair of large yellow spots; the third and fourth segments widen out and the abdomen terminates in a rounded fifth segment; the apex of the fourth segment is more or less yellow. The venter is black with the second segment yellow. The abdomen is covered with an unevenly distributed vestiture which is mostly yellow.

The legs have their coxae and trochanters black, the remainder of the anterior and intermediate legs is reddish, covered with a short white pubescence; the posterior femora are reddish with their apices black, they are conspicuously swollen and contain a few minute ventral spines placed in a row towards the anterior side; the posterior tibiae are considerably curved, yellow at the extreme base then black with the central third red, but they vary somewhat in these colours; the posterior tarsi are black; the hair on the posterior legs is whitish.

The wings are hyaline with brownish stigma and veins. The halteres are yellow.

Female. The female has the same general characters as the male, but differs by the eyes being widely separated and the front between them shines black and blue; also the abdomen has the usual elongate shape of a Syrphid and is more or less parallel sided and further it is entirely black, the yellow markings on the second segment of the abdomen being discernible by the less intensely black colour.

Length.—10 mm.

Hab.—Tasmania; the holotype from Geeveston, 17th Jan., 1916, the allotype from Hobart, 10th March, 1917, four male and three female paratypes from Dunalley, Hobart, and Geeveston, during the months of April, July, September, October, and December. A further small series is in the collection of Mr. C. E. Cole.

New South Wales; one female paratype numbered "41" is in Dr. Ferguson's collection, and is without further data.

Note.—This is a very distinctive species that does not seem to have been previously described. The characters of the antennae and the venation are similar to those of the genus *Chrysotoxum*, but the species differs in some other characters, especially that of the abdomen, on which account it may be necessary to remove this species into another genus.

Sub-family MICRODONTINAE.

Genus *Microdon* Meigen.

Three species of the genus *Microdon* occur on the eastern side of Australia, and two of these extend into Tasmania. They can be recognised readily by the proportion of the antennal joints and in addition *M. variegata* Walker differs from the other two species by having a club-formed abdomen.

| Species | Average length of joints of the antennae. | | | | Remarks. |
|-----------------------------|---|-------|-------|--------|---|
| | 1st. | 2nd | 3rd. | Total. | |
| <i>M. vittatus</i> | .5 mm | .2 mm | .5 mm | 1.2 | Third joint as long as the first. |
| <i>M. pictipennis</i> . . . | .6 | .2 | .9 | 1.7 | Third joint one and one half times the length of the first. |
| <i>M. variegata</i> . . . | .8 | .15 | 2.6 | 3.55 | Third joint three times the length of the first. |

Microdon pictipennis Macquart.

Aphritis pictipennis Macquart, Dipt. Exot., suppl. 4, 1850, p. 129, pl. xii, fig. 12.

Hab.—Tasmania and New South Wales.

Microdon vittatus Macquart.

Aphritis vittatus Macquart, Dipt. Exot., suppl. 4, 1850, p. 129.

Eumerus transiens Walker, Ins. Saund. Dipt., 1852, p. 225.

Microdon brachycerus Knab and Malloch, *Trans. Roy. Soc. S. Austr.*, xxxvi, 1912, p. 235.

Synonymy.—In his description Walker states that a stump of a slightly curved vein proceeds from the upper side of the second submarginal cell; in modern terms this refers to the appendix of the cubital vein in the first posterior cell and denotes that the species is a *Microdon*. A specimen from Sydney agrees with Walker's description in every detail.

Hab.—Tasmania, Victoria and New South Wales.

Microdon variegata Walker.

Ceratophila variegata Walker, Ins. Saund. Dipt., 1852, p. 220, pl. i, fig. 6.

Microgaster aphritinus Thomson, *Eugenies Resa*, Dipt., 1868, p. 491.

Microdon daveyi Knab and Malloch, *Trans. Roy. Soc. S. Austr.*, xxxvi, 1912 p. 233.

Hab.—New South Wales and Victoria. Two specimens from Victoria are in Dr. Ferguson's collection.

Sub-family ERISTALINAE.

Genus *Orthoprosopa* Macquart.

Orthoprosopa Macquart, Dipt. Exot., suppl. 4, 1849, p. 153.

Characters.—This distinct genus appears to be unique to Australia; it contains one rather bare species with an open subcostal cell; the eyes are bare,

touching in the male for a little distance and widely separated in the female; the hind femora are swollen and do not bear a process, a clump of hairs or spines spines.

Type of the genus.—*O. nigra*, Macquart Tasmania.

Orthoprosopa grisea, Walker.

(Pl. 1, fig. 4.)

Heliophilus griseus Walker, *Ent. Mag.* ii, 1835, p. 472. *Id.*, Froggatt, *Austr. Insects*, 1907, p. 303.

Meredon contrarius Walker, *List Dipt. B.M.*, iii, 1849, p. 599.

Orthoprosopa nigra Macquart, *Dipt. Exot. suppl.* 4, 1849, p. 153, Pl. xiii, fig. 5. *Id.*, Skuse, *Proc. Linn. Soc. N.S.W.*, iii., 1888, p. 423 (larvae). *Id.*, Froggatt, *P.L.S.N.S.W.*, xxi., 1896 p. 83, Pl. ix, figs. 6-8.

Synonymy.—This species, well known under the name *Orthoprosopa nigra*, appears to have been described by Walker in 1835 under the name *Heliophilus griseus*, and again in 1849 as *Meredon contrarius*; in both these descriptions the species is recorded from "New Holland."

Macquart's genotype was published during the same year as Walker's second description, and Tasmania was given as the locality, but the species is not represented from that State in recent collections.

Genus *Eristalis* Latreille.

Note.—Under this genus four names are placed as synonyms under three species. Of the remainder, *E. smaragadi* Walker has been recognised as a distinct species, but *E. fulvipes* Macquart, *E. roderi* Bergroth and *E. maculatus* de Meijere have not been recognised in the collections examined. *E. tenax* Linnaeus is a common introduced species that occurs throughout Australia.

Eristalis pulchella Macquart.

Eristalis pulchella Macquart. *Dipt. Exot. suppl.* 1, 1846, p. 127, Pl. xi, fig. 3.

Eristalis aebutius Walker, *List Dipt. B.M.*, iii, 1849, p. 630.

Hab.—Queensland to Tasmania, and Western Australia. Specimens from Rockhampton and King George's Sound are in the Macleay Museum.

Eristalis decorus Macquart.

Eristalis decorus Macquart, *Dipt. Exot. suppl.* 3, 1848, p. 41. *Id.*, Schiner, *Novara Reise*, *Dipt.* 1868, p. 362.

Eristalis sinuata Thomson, *Eugeniés Resa*, *Dipt.* 1868, p. 488.

Hab.—Queensland and New South Wales.

Eristalis punctulatus Macquart.

Eristalis punctulatus Macquart, *Dipt. Exot. suppl.* 2, 1847, p. 58; and suppl. 4, 1850, p. 137. *Id.*, Grimshaw, *Fauna Hawaiensis*, iii, part 2, 1902, p. 82. *Id.*, de Meijere, *Tijd v. Ent.*, li, 1908, p. 265.

Eristalis agno Walker, *List Dipt. B.M.*, iii, 1849, p. 626.

Eristalis epitome Walker, *Ins. Saund. Dipt.*, 1852, p. 250.

Synonymy.—This is a rather variable species for which the above synonymy appears to be correct. Specimens in various collections are labelled *Helophilus bengalensis* Wiedemann, but the species has contiguous eyes in the male and therefore cannot belong to the genus *Helophilus*. In a letter to Dr. Ferguson,

White suggests that the species should be placed in a genus other than *Eristalis*, but does not give his reasons for the change.

Hab.—Queensland, New South Wales, Victoria and South Australia. Walker records it from Western Australia and Tasmania.

Sub-family MILESIINAE.

Genus *Eumerus* Meigen.

Note.—The species belonging to this genus are about the size of a small species of the genus *Syrphus*, which they somewhat resemble, and are often slightly metallic.

Two specimens are represented from Tasmania, and can be distinguished by the relative size of the hind metatarsis in the male.

Judging from the descriptions only *Eumerus fulvicornis* Macquart, *E. latipes* Macquart, and probably *Meredon muscaeformis* Walker, belong to this genus. *E. marginatus* Grimshaw, described from Honolulu, is stated to be a possible importation to the Hawaiian Islands from Australia.

Genus *Xylota* Macquart.

Xylota pleuralis Kertész was described from New South Wales, but the species has not been recognised in the collections examined. The other species belonging to this genus has been recognised.

Xylota flavitarsis Macquart.

Xylota flavitarsis Macquart, Dipt. Exot., suppl. 1, 1846, p. 134; and suppl. 4, 1850, p. 146.

Hab.—Tasmania, a series of both sexes. Victoria, Portland, one female collected by H. W. Davey in the collection of Dr. Ferguson.

Genus *Criorrhina* Meigen.

Under the name *Criorrhina nudiventris*, Macquart has described a species that probably does not belong to this genus.

Criorrhina spadix sp. nov.

Pl. 1, figs 5, 6, and 7.

Description.—This species is of a beautiful brown, almost red, colour, and the face, tibiae, and tarsi are yellow; the wings are hyaline with the anterior border suffused brown.

Male. The head is short, broader than high, about as broad as the thorax and concave behind. The eyes are brown and approximate at a point, not quite touching. The ocellar triangle is brown and about twice as long as the maximum width, and is covered with a vestiture of long brownish yellow hairs; the antennae, inserted about the middle of the head are brown and contain conspicuous hairs. The epistoma is hollow below the antennae, and contains a prominent central knob; the whole face from the antennal triangle to the cheeks is strongly protuberant, brown in colour, but is covered with a tomentum which reflects a golden yellow; so that, where in one position the face is almost entirely brown, in another it appears to be almost completely golden yellow. The cheeks are somewhat small and slightly prominent. The proboscis is black with a slight trace of brown.

The thorax is brown and about as long as broad. A pair of thick median stripes reach two-thirds the length of the thorax; and on each side there is a fur-

ther obscure stripe at about the end of the transverse suture, reaching the apex of the thorax. The whole dorsal surface of the thorax is uniformly covered with a vestiture of rather long thin yellowish hairs, and the anterior border, together with the whole area between the obscure stripes, have in addition to the hairs a yellowish tomentum. Ventrally the thorax is brownish, but somewhat stained with reddish, and is without conspicuous hairs. The scutellum is shining brown, with a similar vestiture to that of the thorax.

The abdomen is somewhat elongate and widest on the third segment. Its length is less than three times the width. There are five conspicuous dorsal segments, the fifth of which is rounded, curving to the underside, and contains the genitalia situated close to the last, apparently the third, ventral segment. The colour of the abdomen is shining brown, covered with pubescence which is longer on the under side; the fifth segment is dull and has the pubescence denser.

The anterior and middle legs are simple; the posterior femora are swollen and the posterior tibiae are bowed. The legs carry soft short hairs, and are without bristles. The coxae and femora are reddish brown, the tibiae and tarsi are yellowish. The hairs on the legs are mostly of the same colour as that part on which they are situated but the femora bear some conspicuous black pubescence on the under side.

The wings are brown along the anterior border, otherwise they are more or less hyaline, and yellow at the base. The halteres are yellow.

Length.—Male, 15 mm.

Hab.—Tasmania; Hobart, 1st December, 1917. The holotype male is unique.

Genus *Deineches* Walker.

Deineches Walker, Ins. Saund. Dipt., 1852, p. 228.

Note.—This genus was created by Walker for a large Australian species that comes close to the genus *Criorrhina*, from which it differs apparently only in the veins that run parallel to the apical border of the wing; these veins merge into each other in a more or less unbroken line in *Deineches*, whilst in *Criorrhina* they are separated by a space, thus breaking the line. It is doubtful if this character is sufficient to justify generic separation.

Deineches nigrofulva Walker.

Pl. 1, fig. 3.

Deineches nigrofulva Walker, Ins. Saund. Dipt., 1852, p. 228, Pl. vi, fig. 7.

Hab.—New South Wales; two specimens in the Macleay Museum and one in the Australian Museum.

EXPLANATION OF PLATE I.

Fig. 1. *Chrysotoxum elongatum* sp. nov., male.

2. " " , the head, seen laterally.

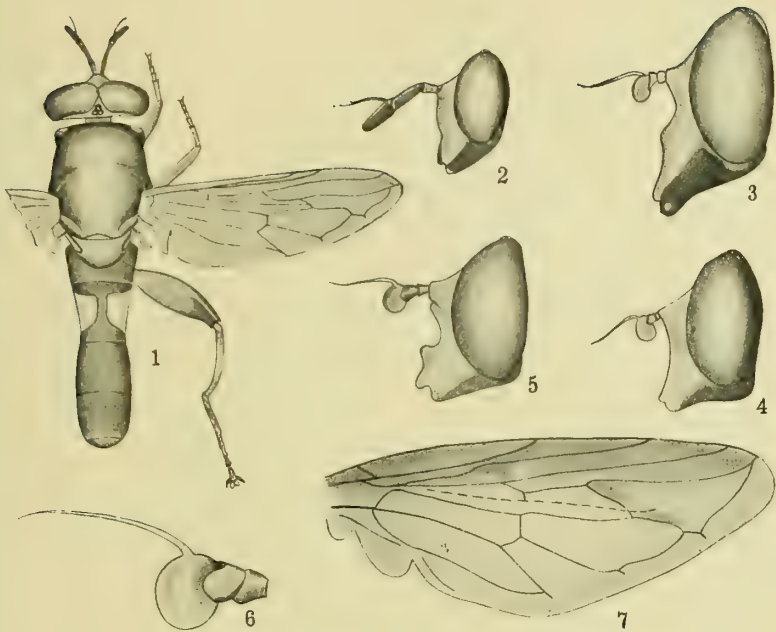
3. The head of *Deineches nigrofulva* Walker, male, seen laterally.

4. The head of *Orthoprosopa griseus* Walker, male, seen laterally.

5. The head of *Criorrhina spadix* sp. nov., male, seen laterally.

6. The antennae of the same.

7. The wing of the same.



Australian Syrphidae (*Diptera*).

THE AUSTRALIAN ZOOLOGIST

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Edited by
LAUNCELOT HARRISON, B.Sc., B.A.,
Lecturer and Demonstrator in Zoology at the University of Sydney.

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Royal Zoological Society of New South Wales.

NEW MEMBERS.—The following new members have been elected:—

ORDINARY MEMBERS.

Messrs. C. C. CAPPER, HEYWOOD CHAPMAN, BEN FULLER, EDWARD PALMER, and
EUGENE VILES, Sydney.

ASSOCIATE MEMBERS.

RALPH C. BLACKET, Queanbeyan; E. P. FLEMING, A. H. S. LUCAS, and
ERWIN NUBLING, Sydney; LOUIS E. D'ARX, Livingstone-street, West End, Towns-
ville, N. Queensland.

HONORARY MEMBER.

In recognition of her services to the Society, in allowing the free use of a room in the city for Council meetings during the past five years, Mrs. G. J. Waterhouse, of Woodford, N.S.W., has been elected an Honorary Member.

RAT PLAGUE AT LORD HOWE ISLAND.

Dr. Eustace W. Ferguson, Principal Microbiologist, Department of Public Health, brought under the notice of the Society a threatened danger to the native fauna of Lord Howe Island. It appears that in 1918 a steamer was beached at the Island, and rats from her got ashore, spreading through the Island. They were causing very grave damage to the *Kentia* Palm seeds, the staple product of the Island, and it was reported that they were also attacking the eggs of the native birds. Unless means were taken very soon to diminish the rats, or otherwise conserve the birds, it seemed likely that some of the species peculiar to the Island might become extinct.

The Council thereupon offered the services of their expert members to the Board of Control of the Island. Mr. E. B. Harkness replied that the Board appreciated the spirit of the offer, as it was alive to the seriousness of the menace, and was already actively engaged in endeavoring to combat the pest. As Mr. Allan R. McCulloch, Zoologist, Australian Museum, was proceeding to the Island on a visit for the benefit of his health, the Board furnished him with credentials, and afforded him every facility to make inquiries and report to them on the best means to protect or preserve the native fauna from the ravages of the rats. Mr. McCulloch sailed in the "Makambo" on the 8th February, and his report will be awaited with interest. As no less than six members of the Council have at one time or another visited the Island, and are all keenly alive to the necessity for preserving its unique avifauna, it is hoped that some practical suggestions will result.

FISHES OF NEW SOUTH WALES.

Owing to ill-health, Mr. McCulloch has been unable to complete his Check-list of the Fishes of New South Wales. A large section is, however, published in this Part, and it is hoped that the remainder will be ready for publication in the next Part of the "Australian Zoologist." The complete work will then be published in book form.

PRELIMINARY NOTE ON THE BREEDING OF *ORNITHORHYNCHUS*
IN 1920.

By Harry Burrell.

Since Part I. of my paper, "Field Notes on the Life History of Monotremes," appeared in Part 8 of Vol. I. of this journal, I have spent another breeding season in the field. So much additional material, and so many new observations have accrued, that I have felt it advisable to delay the publication of Part 2 until this new matter can be incorporated in it. Meantime the material collected is of such prime importance as to justify the present brief account of it.

Professor Harrison, of the Sydney University, on learning that I proposed to make another trip in 1920, impressed upon me the importance of properly preserving any embryonic material obtained, and I have to thank him and his second in command, Mr. E. A. Briggs, as well as Mr. W. Graham, the laboratory assistant to the Department of Zoology, for sending me off adequately equipped with fixing fluids and full instructions as to the methods of using them. The same gentlemen also obtained for me from the Chief Secretary's Department a permit to collect for the University embryological specimens of *Ornithorhynchus*, which is, of course, totally protected. I also took with me a thermometer, which I had carefully standardised before leaving Sydney, for the purpose of obtaining the temperatures of the nesting burrows, and of the females captured in them.

The locality chosen for my operations was the same as in 1919, namely, the Manilla district. Last year, it will be remembered, I spent the month of October in this district, during a period of record drought, and dug out six nests containing young, two with one, three with two, and one with three young, all of which were in a fairly advanced condition. The youngest showed hair appearing beneath the skin, while the oldest were fully furred.

In the spring of 1920 I was kept informed by Mr. J. Maclean, of Retreat Station, Macdonald River, of the condition of the rivers, and of the numbers of platypus observed. In July the three rivers, Manilla, Macdonald, and Namoi, were all in flood, and ten feet above normal level. Falls of rain during the two succeeding months maintained the rivers in a flood condition.

Platypus were reported plentiful, and, as my objective was eggs, I estimated what I considered the right time to go, and proceeded to Manilla in the middle of September. The sequel proved that I had judged aright, as the following tabular statement of results shows:—

- Sept. 20.—Nest with one egg.
- do. 20.—Female with two intra-uterine eggs.
- do. 22.—Nest with twin eggs.
- do. 27.—Nest with one young.
- do. 28.—Nest with twin eggs.
- do. 28.—Nest with one egg.
- do. 30.—Nest with twin young.
- Oct. 2.—Nest with twin eggs.
- do. 2.—Nest with twin young.
- do. 3.—Nest with triplet young.
- do. 4.—Nest with twin young.
- do. 6.—Nest with twin eggs.

The total results were thus:—One female with intra-uterine eggs, six nests with egg or eggs, and five nests with young. The eggs were fixed by making a small incision with a sharp scalpel in the shell and immersing whole in the fixing fluid. The young were also fixed by total immersion, after a small incision had been made in the ventral body wall. All the material, with the exception of one pair of eggs and a couple of young ones which I have kept as trophies, has been handed to Professor Harrison, who writes me as follows:—

"I must congratulate you upon your splendid achievement. No such important collection of embryological material of *Ornithorhynchus* has ever been got together before, and only a man with your intimate knowledge of the habits of this interesting animal could have hoped to obtain so much in a single season. Caldwell obtained eggs in 1884, but I cannot find that their contents were ever described. Kershaw also obtained eggs, but these, again, were not, as far as I am aware, opened. Wilson and Hill have obtained a number of intra-uterine eggs, which they have fully described, but have not dealt with any embryos from the nest. Parkèr, Poulton, and Wilson have all figured early young, the mammary foetus, as Wilson calls it, but these are considerably more advanced than the oldest of the series you have handed me. You may imagine the interest with which Mr. Briggs and myself have opened up the cheese-cloth and cotton wool surrounding the specimens. The opening of the eggs was a ticklish business. We had no idea how the embryo lay within the egg, and were both loth to take the first step, for fear of injuring so precious a specimen. Finally I sent Mr. Briggs out of the laboratory, determined, if I made a hash of it, to have no witness to my shame. I was very relieved, on enlarging your careful incision to a small window, to see a beautifully preserved embryo on the opposite wall of the egg. After that the rest was easy, and we have five nicely graded stages from the egg, as well as four graded mammary foetus, nine stages between the oldest intra-uterine embryo described by Wilson and Hill and the youngest mammary foetus hitherto dealt with. The preservation is admirable, and not a single specimen is injured in any way. We are quite at a loss how adequately to give expression to our gratitude to you for the privilege of examining this interesting and important series of embryos."

The collection and preservation of this embryological material was, of course, incidental to my own studies on the bionomics of the platypus. It is very gratifying to me, however, to find that I have been able to render a valuable service to another branch of biological science, and that the years which I have devoted to the study of *Ornithorhynchus* have not been spent in vain.

As will be seen from the list given above, the number of eggs varies from one to three. I have now found one egg, or one young one, sufficiently often to be quite sure that one is frequently the normal complement. Two other pieces of evidence put this quite beyond doubt. In the first place, dissection of a female captured in a nest containing one egg only showed no trace of another egg in either uterus; while, where two or more eggs are laid, these are always firmly adherent one to another, and I believe that this adhesion takes place prior to laying. I have found one egg, or one young, in six out of seventeen tenanted nests examined during the past three seasons.

Eleven of these nests contained twin eggs or twin young, so two would appear to be the normal number. The twin eggs are attached to one another with their long axes sub-parallel, and Professor Harrison tells me he had to exercise considerable force to pull the adherent walls apart. Of four pairs of twin eggs, in one-only were the eggs equal in size (Plate II., Fig. 3), there being a difference of

one to two millimetres in length between the members of each of the other three pairs.

I have not found three eggs in a nest, but have twice found triplet young. The shells from which the triplets taken on 3rd October, 1920, were hatched, I found in the nest, dry and flattened as shown on the right of Fig. 6 of Plate II. On relaxing these by soaking them in warm water, they assumed the appearance shown on the left of Fig. 4, Plate II. It is plain from the figure that each egg is adherent to both its neighbours.

Of the six "clutches" of eggs taken, only two preserved a full outline (Plate II., Figs. 1, 3), all the others being more or less dented (Figs. 7, 9), while one was so dented that I was doubtful whether it contained a living embryo. This last egg was also very much discolored. After hatching of the young, the shells collapse and become flattened, having the appearance shown in Plate II., Figs. 2, 6 and 8.

The measurements of the eggs in millimetres are as follow:—

| | Length. | Breadth. |
|---------------------|---------|----------|
| A. Single egg . . . | 18 | 14 |
| B. Twin eggs . . . | 16 | 12 |
| | 16 | 12 |
| C. Twin eggs . . . | 17 | 14 |
| | 16 | 14 |
| D. Single egg . . . | 17 | 13 |
| E. Twin eggs . . . | 15 | 26 |
| | 17 | |
| F. Twin eggs . . . | 15 | 25 |
| | 16 | |

In the case of E and F, the breadth is of the two eggs together.

The triplets taken on 3rd October died before measurements were made, but the young from the other four nests measured as follows:—

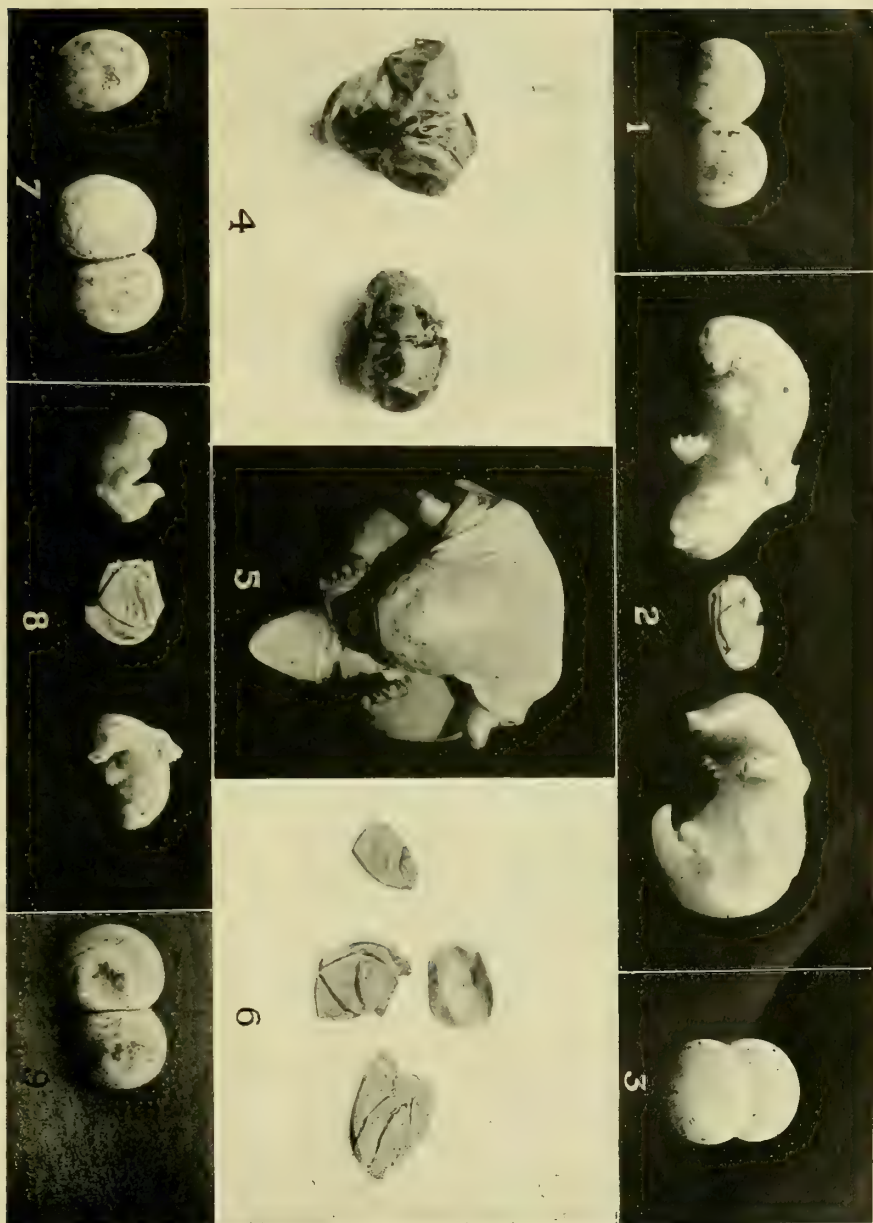
| | |
|-----------------|---------|
| G. Twin young | 20 mm. |
| H. Twin young. | 40 mm. |
| I. Twin young | 65 mm. |
| J. Single young | 103 mm. |

These measurements were made from the living animals, along the dorsal curvature, from the tip of the snout to the tip of the tail. Photographs from life of two pairs of twins, G (Fig. 8), and I. (Fig. 2), and of the single young one J. (Fig. 5) are shown on Plate II. The twins G. I judge to have been very recently hatched, as the egg shells were still soft, and the navel was not closed up, but showed the remains of the yolk-stalk still protruding. On these grounds I think it safe to state that the young *Ornithorhynchus* is 20 mm. in length at hatching. That there is a fairly considerable variation in the date of laying is shown by the fact that the single young one, J., which was 103 mm. in length, was taken on 27th September, and must have been hatched more than a fortnight earlier; while the newly-hatched twins just mentioned were taken on 4th October.

I took the temperature of the nesting chambers by thrusting in the thermometer the moment I broke into them, and blocking the entrance immediately with a piece of sacking. As the chamber was always broken into by carefully breaking through the guarding plug which the female had placed in the tunnel, I believe that this method, crude as it may appear, would give fairly accurate results. Of eleven temperatures taken, the minimum was 63° F., and the maximum 67° F. the average being 64.9° F. The average of seven measurements in



Copyright Photo. by HARRY BURRELL.
Nests of *Ornithorhynchus*.



Eggs and Young of *Ornithorhynchus*.

Copyright Photo. by HARRY BURRILL.

which the female was present in the chamber when the temperature was taken gives 64.5° F.; and of four measurements when the parent was not at home, 65.5° F.

The rectal temperatures of seven females captured in the nesting chambers ranged from 86° to 92° F.; the average being 89.9° F. The blood heat of *Ornithorhynchus* would thus appear to be a little more than that measured by Dr. Wardlaw (P.L.S.N.S.W.) for *Echidna*.

Plate I. shows five nests of *Ornithorhynchus* composed of various different materials, details of which will be found in the explanation below.

EXPLANATION OF PLATES.

Plate I.

Nests of *Ornithorhynchus*.

- Fig. 1. Nest composed of grass.
 .. 2. Nest composed of willow-roots.
 .. 3. Nest composed of roots of reed (*Arundo*).
 .. 4. Usual type of nest, 90 % gum-leaves and grass.
 .. 5. Nest composed of stems of *Arundo*.

Plate II.

Eggs and young of *Ornithorhynchus*.

- Fig. 1. Twin eggs, end view.
 .. 2. Twin young of 65 mm., and the shells of the eggs from which they were hatched.
 .. 3. Side view of the eggs shown in Fig. 1.
 .. 4. Relaxed shells of triplet and twin eggs shown to the right below in Fig. 6.
 .. 5. Young of 103 mm.
 .. 6. Above, a dried-up egg; below, shells of single, twin, and triplet eggs from which the young have hatched.
 .. 7. Single and twin eggs from closely adjacent burrows.
 .. 8. Twin young of 20 mm., just hatched, with shells.
 .. 9. Twin eggs.
 All figures of natural size, and from photographs in the field.

CHECK-LIST OF THE FISH AND FISH-LIKE ANIMALS OF
NEW SOUTH WALES.

Part ii.

By Allan R. McCulloch, Zoologist, Australian Museum.

Fishes.—CLASS PISCES.

BONY FISHES—Subclass TELEOSTEI.

The major divisions or Orders of the Fishes are each distinguished by complicated combinations of several external and internal characters; any of these may vary within the limits of a division, and may approach or even overlap those of some other division. There can accordingly be no simple key by which the Orders may be distinguished, but the characteristic features of each are stated under their proper headings, as follows:—

Herrings and Trout-like Fishes—Order ISOSPONDYLI.

Only one true dorsal fin, which is without spines; a secondary adipose dorsal may be present or absent.

- A. One dorsal fin, no secondary adipose fin posteriorly.
- B. Body scaly.
 - C. 9-16 rays in the ventral fins.
 - D. An elongate bony plate on the throat between the two branches of the lower jaw. Fam. *Elopidae* (No. xxvi.).
 - DD. No such bony plate. Fam. *Albulidae* (No. xxvii.).
 - CC. Not more than 8 rays in the ventral fin.
 - E. No lateral line.
 - F. Dorsal fin posterior, opposite the anal. Fam. *Chirocentridae* (No. xxviii.).
 - FF. Dorsal fin median, well before the anal.
 - G. Maxilla very large, greatly produced backward. Fam. *Engraulidae* (No. xxix.).
 - GG. Maxilla small or of moderate size, not produced unusually far backward. Fam. *Clupeidae* (No. xxx.).
 - EE. Lateral line present.
- H. Mouth terminal, no rostral barble, tail forked. Fam. *Chanidae* (No. xxxi.).
- HH. Mouth overhung by the snout, a rostral barble, tail emarginate. Fam. *Gonorhynchidae* (No. xxxii.).
- BB. Body naked. Fam. *Galaxiidae* (No. xxxiii.).

AA. A secondary adipose dorsal fin present posteriorly.

I. Dorsal fin opposite or before the ventrals.

J. Jaws with teeth, scales small, fluviatile. Fam. *Salmonidae* (No. xxxiv.).JJ. Jaws toothless, scales large, marine. Fam. *Argentinidae* (No. xxxv.).

II. Dorsal fin behind the ventrals.

K. Dorsal before anal, 7 ventral rays. Fam. *Aplocheilichthyidae* (No. xxxvi.).

KK. Dorsal opposite anal, 6 ventral rays.

Fam. *Retropinnidae* (No. xxxvii.).

XXVI.

Family ELOPIDAE.

A. Dorsal and anal fins each with a basal scaly sheath; the dorsal longer than the anal, its last ray not produced. *Elops* (46).AA. Dorsal and anal fins without scaly sheaths; the anal longer than the dorsal, its last ray produced. *Megalops* (46).45. *ELOPS* Linn., Syst. Nat. 12th. ed., 1766, p. 518 (*saurus*).45a. *E. HAWAIIENSIS*. GIANT HERRING. *Id.* Regan, A.M.N.H. (8) iii, 1909, p. 39, *E. machnata* Richardson (*nec* Forskal), Ichth. Ereb. & Terr., 1846, p. 59, pl. 36, 3-5. (Pl. iv.).

A tropical species ranging southward to Port Jackson. Attains a length of about four feet, and is good eating.

46. *MEGALOPS* Lacep., H. N. Poiss. v, 1803, p. 289 (*filamentosus*).46a. *M. CYPRINOIDES*. OX-EYED HERRING. *Clupea cyprinoides* Brouss., Ichth., 1782, pl. 9. *M. filamentosus* Bleeker, Atlas Ichth. vi, 1872, p. 86, pl. 273, I. (Pl. iv.).

A tropical estuarine species entering fresh water; occurs in the northern river estuaries.

XXVII.

Family ALBULIDAE.

47. *ALBULA* (Gronow) Scopoli, Introd. Nat. Hist., 1777, p. 450—*vide* Jordan, Gen. Fish. I, 1917, p. 42 (*vulpes*).47a. *A. VULPIS*. LADY FISH. *Esox vulpes* Linn., Syst. Nat. 10th. ed., 1758, p. 313. *Conorhynchus glossodon* Bleeker, Atlas Ichth. vi, 1872, p. 83, pl. 270, I. (Pl. iv.).

Occurs in all tropical seas; only once recorded from New South Wales.

XXVIII.

Family CHIROCENTRIDAE.

48. *CHIROCENTRUS* Cuvier, Reg. Anim. ii, 1817, p. 178 (*dorab*).48a. *C. DORAB*. WOLF HERRING. *Clupea dorab* Forsk., Descr. Anim., 1775, p. 72; *Chirocentrus dorab* Bleeker, Atlas Ichth. vi, 1872, p. 92, pl. 271, 3. (Pl. iv.).

A giant tropical species reaching a length of twelve feet. Not satisfactorily recorded from New South Wales.

XXIX.

Family ENGRAULIDAE.

49. *ENGRAULIS* Cuvier, R. Anim. ii, 1817, p. 174 (*encrasicolus*).49a. *E. AUSTRALIS*. AUSTRALIAN ANCHOVY. *Atherina australis* Shaw, White's Voy. N.S. Wales, 1790, p. 296 and plate opposite. *E. australis* McCulloch, Rec. Austr. Mus. xiii. 2, 1920, p. 43, pl. 12, 1. (Pl. iv.).

Occurs in enormous shoals off the coast. This species is very similar to the European Anchovy.

XXX.

Family CLUPEIDAE.

- A. Belly rounded, covered with ordinary scales.
- B. Dorsal before the ventrals; eye entirely protected by a thick transparent membrane. *Etrumeus* (50).
- BB. Dorsal opposite the ventrals; eye partly exposed. *Stolephorus* (51).
- AA. Belly compressed, with a serrated edge of spiniform scales.
- C. Median scales before the dorsal fin spiniform, forming a serrated edge as on the ventral profile.
- D. Ventral before the dorsal; marine. *Hyperlophus* (52).
- DD. Ventral below the dorsal; fluviatile. *Potamalosa* (53).
- CC. No spiniform scales on the back.
- E. Mouth terminal, larger, the jaws not forming a sharp angle at their symphyses; posterior dorsal ray not produced.
- F. Operculum with several radiating grooves. *Sardinia* (54).
- FF. Operculum with only one groove near its anterior margin. *Harengula* (55).
- EE. Mouth subterminal, small; jaws forming a sharp angle at their symphyses; posterior dorsal ray produced. *Nematalosa* (56).

50. *ETRUMEUS* Bleeker, Verh. Bat. Gen. xxv., 1853, Japan, p. 48 (*micropus*).

50a. *E. JACKSONIENSIS*. MARAY. *Id.* Macleay, P.L.S. N.S.W. iii, 1878, p. 36, pl. 4, 1. *Id.* McCulloch, Rec. Austr. Mus. i. 3, 1914, p. 211, pl. 29. (Pl. iv.).

Apparently a southern species and not common in New South Wales waters.

51. *STOLEPHORUS* Lacep., H. N. Poiss. v, 1803, p. 381 (*japonicus*).

51a. *S. ROBUSTUS*. BLUE SPRAT. *Spratelloides robustus* Ogilby, P.L.S. N.S.W. xxii, 1897, p. 64. *S. robustus* McCulloch, Rec. Austr. Mus. xiii, 2, 1920, p. 42, pl. 11, 1. (Pl. iv.).

A small species growing to about 3 inches long, and occurring in shoals off the coast.

52. *HYPERLOPHUS* Ogilby, Rec. Austr. Mus. ii, 1892, p. 26 (*sprattellides*).

A. Anal fin commencing well behind the last dorsal ray. *vittatus* (52a).

AA. Anal fin commencing below the last dorsal ray. *translucidus* (52b).

52a. *H. VITTATUS*. SANDY SPRAT. *Meletta vittata* Cast., Res. Fish. Austr., 1875, p. 46. *H. vittatus* McCulloch, Rec. Austr. Mus. xi, 1917, p. 163, pl. 29, 1-2. (Pl. iv.).

Very abundant on the coast, occurring in shoals, and growing to about five inches in length. An excellent food-fish.

52b. *H. TRANSLUCIDUS*. *Id.* McCulloch, Rec. Austr. Mus. xi. 7, 1917, p. 165, pl. 29, 3.

A small species known only from a few specimens.

53. *POTAMALOSA* Ogilby, P.L.S. N.S.W. xxi, 1897, p. 504 (*novae-hollandiae*).

53a. *P. NOVAE-HOLLANDIAE*. FRESH-WATER HERRING. ?*Meletta novae-hollandiae* Cuv. & Val., H. N. Poiss. xx, 1847, p. 376. *Clupea novae-hollandiae* Gthr., B. M. Cat. Fish. vii, 1868, p. 431. *P. novae-hollandiae* McCulloch, Rec. Austr. Mus. xi. 7, 1917, p. 166, pl. 29, 4. (Pl. v.).

Abundant in the coastal rivers and growing to 12 inches long. Small specimens are good eating, but the larger ones are very bony.

54. SARDINIA Poey, Memoirs Cuba ii, 1860, p. 311 (*pseudohispanica*).

54a. S. NEOPILCHARDUS. AUSTRALIAN PILCHARD. *Clupea neopilchardus* Stdr., Denk. Akad. Wiss. Wien xli. i, 1879, p. 12. *S. neopilchardus* McCulloch, Rec. Austr. Mus. xii. 8, 1919, p. 172, pl. 26, I. (Pl. v.).

Occurs in enormous shoals periodically. Length about 10 inches. This species is very similar to the European Pilchard or Sardine.

55. HARENGULA Cuv. & Val., H. N. Poiss. xx, 1847, p. 280 (*latulus*).

55a. H. CASTELNAUL. HERRING. *Kowala castelnaui* Ogilby, P.L.S. N.S.W. xxii., 1897, p. 66. *Sardinella castelnaui* Stead, Ed. Fish. N.S. Wales, 1908, p. 26, pl. 5. (Pl. v.).

Occurs in vast shoals at times. Length 9 inches.

56. NEMATALOSA Regan, A.M.N.H. (8) xix., 1917, p. 312.

A. Dorsal with 16-18 rays; a black shoulder spot usually present; marine. *come* (56a).

AA. Dorsal with 13-16 rays; no dark shoulder spot; fluviatile.

B. Body deeper.

erebi (56b).

BB. Body more elongate.

horni (56c).

56a. N COME HAIRBACK HERRING. *Chatoessus come* Rich., Ichth. Erebus & Terror, 1846, p. 62, pl. 38, 7-10. *Dorosoma nasus* Bleeker (*nec* Bloch), Atlas Ichth. vi, 1875, p. 142, pl. 260, 4. (Pl. v.).

The Australian species of *Nematalosa* occurring in the sea, which has been incorrectly recorded as *N. nasus*, is apparently referable to *N. come*. It is restricted to the northern portion of the New South Wales coast.

56b. N. EREBI. BONY BREEM. *Chatoessus erebi* Gthr., B.M. Cat. Fish. vii, 1868, p. 407.

Inhabits the fresh waters of the Murray River system. Length 13 inches.

56c. N. HORN. *Chatoessus horni* Zietz, Rept. Horn. Exped. ii, 1896, p. 180, pl. 16, 6.

This is apparently merely a slender variety of the preceding species.

XXXI.

Family CHANIDAE.

57. CHANOS Lacep., H. N. Poiss v, 1803, p. 395 (*arabicus*).

57a. C. CHANOS SALMON HERRING. *Mugil chanos* Forsk., Deser. Anim., 1775, p. 74. *Lutodeira salmonea* Rich., Ichth. Erebus & Terror, 1846, p. 58, pl. 36, 1-2. (Pl. v.).

A tropical species, not common in this State. Length to 4 feet.

XXXII.

Family GONORHYNCHIDAE.

58. GONORHYNCHUS Cuvier, Reg. Anim. ii, 1817, p. 196 (*gonorynchus*).

58a. G. GREYI. SAND FISH. *Rhynchana greyi* Rich., Ichth. Erebus & Terror, 1845, p. 44, pl. 29, 1-6. (Pl. v.).

G. parvimanus Ogilby, Ann. Qld. Mus. 10, 1911, p. 34, is probably the young of *G. greyi*. Occasionally taken on sandy bottoms. Length 13 inches.

XXXIII.

Family GALAXIIDÆ.

59. GALAXIAS Cuvier, R. Anim. ii, 1817, p. 183 (*truttaceus*).

A. Ventrals with 7 rays.

B. Origin of anal opposite that of dorsal.

attenuatus (59a).

BB. Origin of anal behind that of dorsal.

C. Anal origin below or before middle of dorsal.

D. Lower jaw projecting beyond upper.

planiceps (59b).

DD. Jaws equal.

E. Anal reaching to or almost to base of caudal when adpressed;
pectoral reaching half its distance from ventral.

coxii (59c).

EE. Anal not nearly reaching the caudal base when adpressed;
pectoral not reaching half its distance from the ventral.

bongbong (59d).

CC. Anal origin behind middle of dorsal.

findlayi (59e).

AA. Ventrals with six rays.

dissimilis (59f).

59a. G. ATTENUATUS. JOLLYTAIL. *Mesites attenuatus* Jenyns, Zool. Beagle iii, Fish., 1842, p. 121, pl. 22, 5. G. *attenuatus* Regan, P.Z.S. 1905 (1906), p. 368, pls. 12, 1 and 13, 2. (Pl. v.).

A small fish about six inches long, occurring in fresh waters near the sea. The young are developed in the sea, but make their way into fresh water at an early stage. The young of this and other species form the New Zealand Whitebait.

59b. G. PLANICEPS. *Id.* Macleay, P.L.S. N.S.W. vi, 1881, p. 233. G. *waitii* Regan, P.Z.S. 1905 (1906), p. 376, pl. 11, 2.

A comparison of the types of G. *planiceps* with paratypes of G. *waitii* proves the two to be similar in all details.

59c. G. COXII. MOUNTAIN TROUT. *Id.* Macleay, P.L.S. N.S.W. v, 1880, p. 45.

Id. Regan, P.Z.S. 1905 (1906), p. 380, pl. 12, 2. (Pl. v.).

Reaches a length of 7 inches.

59d. G. BONGBONG. *Id.* Macleay, P.L.S. N.S.W. vi, 1881, p. 233.

59e. G. FINDLAYI. *Id.* Macleay P.L.S. N.S.W. vii, 1882, p. 107. *Id.* Regan, P.Z.S. 1905 (1906), p. 382, pl. 13, 3.

A small species ascending the streams to near the summit of Mt. Kosciusko.

59f. G. DISSIMILIS. *Id.* Regan, P.Z.S. 1905 (1906), p. 383.

The unique holotype of this species is perhaps merely an abnormal specimen.

[G. *scottii* (Kreffit) Ogilby, Cat. Fish. N.S. Wales, 1886, p. 55, is a *nomen nudum*. G. *olidus* Gthr., has been incorrectly recorded from New South Wales by Ogilby, *op. cit.*, p. 54.]

XXXIV.

Family SALMONIDÆ.

60. SALMO Linn., Syst. Nat. 10th ed., 1758, p. 308 (*salar*).

A. No red or pink lateral band from head to tail; spots larger and scattered.

fario (60a).

AA. A red or pink lateral band from head to tail; spots smaller and closer set.

irideus (60b).

60a. S. FARIO. BROWN TROUT. *Id.* Linn., Syst. Nat. 10th ed., 1758, p. 309; *Id.* Day, Fish. Gt. Brit. & Irel. ii, 1880-1884, p. 95, pl. 113, 1. (Pl. vii.).

Introduced into various streams in New South Wales, but with less success than the following species.

- 60b. *S. IRIDEUS*. RAINBOW TROUT. *Id.* Gibbons, P. Cal. Acad. Nat. Sci., 1855, p. 36; *Id.* Jord. & Evm., Fish. N. & Mid. Amer. i, 1896, p. 500, pl. 81, 216. (Pl. vii.).

Successfully acclimatised in many rivers in various parts of the State, and providing good sport for rod-fishermen.

Attempts have been made at different times to acclimatise the Loch Leven Trout (*Salmo levenensis*), the Salmon Trout (*S. trutta*), the American Brook Trout (*Salvelinus fontinalis*), and the Sockeye Salmon (*Oncorhynchus nerka*), but according to Mr H. K. Anderson, of the State Fisheries Department, none of these have thrived.

XXXV. Family ARGENTINIDAE.

61. ARGENTINA Linn., Syst. Nat. 10th ed., 1758, p. 315 (*sphyraena*).

- 61a. A. ELONGATA. *Id.* Hutton, A.M.N.H. (5) iii, 1879, p. 53. *Id.* Waite, Rec. Cantb. Mus. i, 1911, p. 161, pl. 24. (Pl. vi.).

A small deep water species, occasionally taken by trawlers.

XXXVI. Family APLOCHITONIDAE.

62. PROTOTROCTES Gthr., B.M. Cat. Fish. v, 1864, p. 382 (*maræna*).

- 62a. P. MARAENA. AUSTRALIAN GRAYLING. *Id.* Gthr., *Tom. cit.* *Id.* Waite, Rec. Austr. Mus. iv, 1902, p. 265, pl. 41. (Pl. vi.).

A Trout-like fish, growing to 12 inches long, and sometimes occurring in shoals in some coastal streams.

XXXVII. Family RETROPINNIDAE.

63. RETROPINNA Gill, Proc. Acad. Philad. 1862, p. 14 (*retropinna*).

- 63a. R. SEMONI. AUSTRALIAN SMELT. *Prototroctes semoni* Weber, Zool. Forsch. Austr. v, 1895, p. 274. *R. semoni* McCulloch, Rec. Austr. Mus. xiii. 2, 1920, p. 49, pl. 11, 2-3. (Pl. vi.).

A minute fish, about 3 inches long, abundant in both the coastal and inland streams of the State. Very closely allied to the New Zealand Whitebait.

Sergeant Baker, Cucumber Fish, and Saury. Order INIOMI.

Differing from the Order Isospondyli in having the shoulder-girdle incomplete, there being no mesocoracoid arch.

A. Body scaly; ventrals near the pectorals.

B. Maxilla expanded posteriorly.

C. A broad movable supramaxillary bone; dorsal fin long.

Family *Aulopidae* (No. xxxviii.).

CC. No movable supramaxillary bone; dorsal fin short.

Family *Sudidae* (No. xxxix.).

BB. Maxillary narrow posteriorly, without supramaxillaries.

Family *Synodontidae* (No. xl.).

AA. Body naked; ventrals far behind the pectorals.

Family *Alepisauridae* (No. xli.).

XXXVIII.

Family AULOPIDAE.

64. AULOPUS Cuvier, Reg. Anim. ii, 1817, p. 170 (*filamentosus*).

64a. A. PURPUPISSATUS. SERGEANT BAKER. *Id.* Rich., Icon. Pisc., 1843, p. 5, pl. 2, 3. *Id.* McCoy, Prodr. Zool. Viet. dec. v, 1881, pls. 54-55. (Pl. vi.).

A brilliantly coloured fish, commonly captured along the coast. The male differs from the female in having the anterior dorsal rays prolonged. Length about 2 feet.

XXXIX.

Family SUDIDAE.

65. CHLOROPHTHALMUS Bonap., Faun. Ital., Fasc. 138, 1840 (*agassizii*).

65a. C. NIGRIPINNIS. CUCUMBER FISH. *Id.* Gthr., A.M.N.H. (5) ii, 1878, p. 182, and Chall. Zool. xxii, 1887, p. 193, pl. 51, a. (Pl. vi.).

Plentiful in deep water where it is taken by trawlers. Length 10 inches.

XL.

Family SYNODONTIDAE.

A. Eye-diameter longer than the snout and greater than the interorbital width.

Trachinocephalus (66).

AA. Eye-diameter shorter than the snout and less than the interorbital width.

Saurida (67).

66. TRACHINOCEPHALUS Gill, P. Acad. Philad. 1861, Suppl. p. 53 (*myops*).

66a. T. MYOPS. PAINTED SAURY. *Salmo myops* (Forst.) Bloch & Schn., Syst. Ichth., 1801, p. 421. *Synodus myops* Bleeker, Atlas Ichth. vi, 1875, p. 153, pl. 278, 3. (Pl. vi.).

An ornate tropical species, not common in this State.

67. SAURIDA Cuv. & Val., H.N. Poiss. xxii, 1849, p. 499 (*tumbil*).

A. $4\frac{1}{2}$ scales between the dorsal fin and the lateral line; fins not spotted.

tumbil (67a).

AA. $3\frac{1}{2}$ scales between the dorsal fin and the lateral line; fins spotted.

gracilis (67b).

67a. S. TUMBIL. SAURY. *Salmo tumbil* Bloch, Ichth. xii, 1795, p. 100, pl.

430. *Saurida tumbil* Blkr., Atlas Ichth. vi, 1875, p. 155, pl. 277, 4. (Pl. vi.).

A tropical species, occasionally extending southward to Port Jackson.

67b. S. GRACILIS. *Saurus gracilis* Quoy & Gaim., Zool. Uranie, 1824, p. 224.

Saurida nebulosa Blkr., Atlas Ichth. vi, 1875, p. 156, pl. 277, 1.

Rare in New South Wales waters.

XLI.

Family ALEPISAUROIDAE.

68. ALEPISAUROS Lowe, P.Z.S. 1833, p. 104 (*ferox*).

68a. A. FEROX. *Id.* Lowe, *Tom. cit.*, and Tr. Zool. Soc. i, 1834, p. 124, pls. 19 & 59. *Id.* Goode & Bean, U.S. Nat. Mus. Spec. Bull. ii, 1895, p. 117, pl. 38, 142. (Pl. vi.).

A rare oceanic fish reaching five feet in length.

Order OSTARIOPHYSI.

CARPS—Suborder CYPRINOIDEI.

Fresh water fishes with a single dorsal fin, which is armed with one serrated spine anteriorly.

XLII.

Family CYPRINIDAE.

69. CARASSIUS Nilsson, Prodr. Ichth. Scandan. iv, 1832, p. 290 (*carassius*).

69a. C. CARASSIUS. CARP. *Cyprinus carassius* Linn., Syst. Nat. 10th ed., 1758, p. 321.

Since the introduction of this and the succeeding species into Australia, they have spread rapidly, and are now found in most of our fresh waters. They devour the eggs of other fishes, and as they are of no value as food-fishes, are to be regarded as pests.

69b. C. AURATUS. GOLD FISH. *Cyprinus auratus* Linn., Syst. Nat. 10th ed., 1758, p. 322. *Carassius auratus* Day, Fish. Gt. Brit. & Irel. ii, 1880-1884, p. 166, pl. cxxx, 2. (Pl. vii.).

This species is so variable as to be scarcely distinguishable from the Carp, though its scales are typically larger. Its colour varies from greenish-black to silver and red.

Other Cyprinoids said to have been introduced into New South Wales are the Tench, *Tinca tinca* Linn. (*vide* Ogilby, Cat. Fish. N.S. Wales, 1886, p. 53), the Roach, *Leuciscus rutilus* Linn. (*vide* Stead, Fish Austr., 1906, p. 39), and a species of *Carpoides* (*vide* Macleay, P.L.S. N.S.W. (2) iii, pp. 1507 & 1559).

CAT FISHES—Suborder SILUROIDEI.

Pectoral fins armed with spines.

A. Caudal pointed, united with the second dorsal and anal fins.

Family *Plotosidae* (No. xliii.).

AA. Caudal forked, quite distinct from the dorsal and anal fins.

Family *Ariidae* (No. xliv.).

XLIII.

Family PLOTOSIDAE.

A. Ventrals below the anterior portion of the second dorsal; a dendritic anal appendage.

B. Gill-membranes meeting across, and narrowly united with the isthmus.

C. Axillary pore minute; premaxillary teeth numerous. *Plotosus* (70).

CC. Axillary pore larger; premaxillary teeth few. *Cnidoglanis* (71).

BB. Gill-membranes separated by a wide isthmus; axillary pore minute.

Euristhmus (72).

AA. Ventrals in advance of the second dorsal; no dendritic anal appendage.

Tandanus (73).

70. PLOTOSUS Lacep., H.N. Poiss. v, 1803, p. 129 (*anguillaris*).

70a. P. ANGUILLARIS. STRIPED CAT FISH. *Platystacus anguillaris* Bloch, Ichth. i, 1794, pl. 373, 3. *Plotosus arab* Bleeker, Atlas Ichth. ii, 1862, p. 98, pl. 95, 2. (Pl. vii.).

An ornate tropical marine species which is not common on this coast.

71. CNIDOGLANIS Gthr., Brit. Mus. Cat. Fish. v, 1864, p. 27 (*megastomus*).

71a. C. MEGASTOMUS. ESTUARY CAT FISH. *Plotosus megastomus* Rich., Ichth. Erebus & Terror, 1845, p. 31, pl. 21, 1-3. (Pl. vii.).

Very common on muddy bottoms all along the coast, and growing to about three feet in length. Like all other members of the family, this species inflicts painful wounds with its spines.

72. EURISTHMUS Ogilby, P.L.S. N.S.W. xxiv, 1899, p. 154 (*elongatus*).

72a. E. LEPTURUS. LONG-TAILED CAT FISH. *Cnidogobius lepturus* Gthr., Brit. Mus. Cat. Fish. v, 1864, p. 28. (Pl. vii).

73. TANDANUS Mitchell, Exp. Int. E. Austr. i, 1838, p. 95 (*tandanus*).

73a. T. TANDANUS. FRESH-WATER CAT FISH. *Id.* Mitchell, *Op. cit.*, p. 95, pl. 5, 2. *Id.* Roughley, Fish. Austr., 1916, p. 19, pl. 2. (Pl. vii.).

Reaches a length of over two feet, and occurs in all western waters and some coastal streams. It is a valuable food-fish, and it constructs a nest of pebbles to protect its eggs.

(*T. obscurus* Gthr., has been included in a N.S. Wales list on insufficient evidence—Ogilby, Cat. Fish N.S. Wales, 1886, p. 50.)

XLIV.

FAMILY ARIIDAE.

A. Teeth of palate in three groups on each side, the hinder group extending backward. *Netuma* (74).

AA. Teeth of palate in two transverse groups on each side; no third group extending backward. *Hexanematichthys* (75).

74. NETUMA Blkr. Act. Soc. Sci. Indo-Neerl. iv, 1858, p. 62 (*nasuta*).

74a. N. THALASSINA. GIANT SALMON CATFISH. *Bagrus thalassinus* Ruppell, N.W. Fische, 1828, p. 75, pl. 20, 2. *N. thalassina* and *N. nasuta* Blkr., Atlas Ichth. ii, 1863, p. 28, pl. 61. (Pl. vii.).

A large tropical fish occurring in the estuaries of the northern rivers. It carries its eggs in its mouth until they hatch.

75. HEXANEMATICTHYS Blkr., Act. Soc. Sci. Indo-Neerl. iv, 1858, p. 61 (*sundaicus*).

75a. H. AUSTRALIS. SMALLER SALMON CATFISH. *Arius australis* Gthr., Proc. Zool. Soc. 1867, p. 103, fig.—head.

Grows to about 18 inches long, and occurs in the estuaries of the northern rivers.

Pigmy Eels. Order SYMBRANCHII.

Form Eel-like. Only one gill-opening, which is on the ventral surface.

XLV.

FAMILY CHEILOBRANCHIDAE.

76. CHEILOBRANCHUS Rich., Ichth. Erebus & Terror, 1845, p. 50 (*dorsalis*).

76a. C. RUFUS. RED-BANDED PIGMY EEL or SHORE EEL. *Chilobranchnus rufus* Macleay, P.L.S. N.S.W. vi, 1881, p. 266; *Id.* Waite, Rec. Austr. Mus. vi, 1906, p. 195, pl. 36, 1. (Pl. viii.).

A small fish, common just below low-tide mark. Length 4 inches.

76b. C. PARVULUS. *Cheilobranchnus parvulus* McCulloch, Rec. Austr. Mus. vii, 1909, p. 316, fig. 18.

Plentiful in rock-pools on the coast, and reaching only 2 inches in length.

Eels.—Order APODES.

Form Eel-like. Two gill-openings which are lateral in position.

- A. Body covered with minute scales. Family *Anguillidae* (No. xlv.).
 AA. Body naked.
 B. Tip of tail surrounded by fin-membranes.
 C. Posterior nostril superior or lateral.
 D. Pectoral fin present.
 E. Canine teeth on jaws and vomer. Family *Muraenesocidae* (No. xlvii.).
 EE. No canine teeth. Family *Leptocephalidae* (No. xlviii.).
 DD. No pectoral fins. Family *Muraenidae* (No. xlix.).
 CC. Posterior nostril in upper lip near the eye. Family *Echelidae* (No. l.).
 BB. Tip of tail free, without fin-membranes. Family *Ophichthyidae* (No. li.).

XLVI. Family ANGUILLIDAE.

77. *ANGUILLA* Shaw, Gen. Zool. iv, 1803, p. 15 (*vulgaris*).

77a. A. AUSTRALIS. SHORT-FINNED EEL. *Id.* Rich., Proc. Zool. Soc. 1841, p. 22, and Ichth. Erebb. & Terr. 1848, p. 112, pl. 45, 1-5. (Pl. viii.).

Abundant in all coastal rivers and adjoining fresh waters, and descending to the sea to breed.

77b. A. REINHARDTII. LONG-FINNED EEL. *Id.* Sldr., S.B. Akad. Wiss. Wien iv. i, 1867, p. 15, fig. a-b.

Distinguished from the preceding species only by having the dorsal fin extending farther forward. Length to over 4 feet.

XLVII. Family MURAENESOCIDAE.

78. MURAENESOX McClelland, Cale. Journ. N. Hist. iv, 1843, p. 408 (*tricuspidata*).

78a. M. CINEREUS. SILVER EEL. *Muraena cinerea* Forsk., Deser. Anim., 1775, p. 22. *Muraenesox bagio* Blkr., Atlas Ichth., iv, 1864, p. 24, pl. 26, 2. (Pl. viii.).

A tropical species. Length to five feet.

XLVIII. Family LEPTOCEPHALIDAE.

A. Teeth of jaws juxtaposed to form a cutting edge.

AA. Jaw-teeth in bands, not forming a cutting edge.

79. LEPTOCEPHALUS Gmelin, Syst. Nat. i. 3, 1789, p. 1150 (*morrisii*).

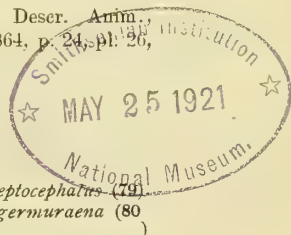
79a. L. LABIATUS. CONGER EEL. *Conger labiatus* Castelnau, P.L.S. N.S.W. iii, 1879, p. 396.

Scarcely distinguishable from the well known Conger of Europe. Length to 3 feet.

80. CONGERMURAENA Kaup, Cat. Apod. Fish., 1856, p. 108 (*balearica*).

80a. C. HABENATA. LITTLE CONGER EEL. *Congrus habenatus* Rich., Ichth. Erebb. & Terr., 1849, p. 109, pl. 50, 1-5. (Pl. viii.).

Apparently common in deeper water, and sometimes thrown up on beaches after storms. Length about 12 inches.



XLIX.

Family MURAENIDAE.

A. Most of the teeth acute.

Gymnothorax (81).

AA. Most of the teeth blunt.

Echidna (82).

81. GYMNOTHORAX Bloch, Ichth. xii, 1797, p. 71 (*reticulatus*). The validity of this name is questionable.

A. Teeth present on the vomer.

B. Colouration almost uniform.

prasinus (81a).

BB. Colouration variegated.

C. Brown with lighter undulous markings.

undulatus (81b).

CC. Light with closely set darker spots.

pictus (81c).AA. No teeth on the vomer; body and fins with large light ocelli. *prionodon* (81d).

81a. G. PRASINUS GREEN EEL. *Muraena prasina* Rich., Ichth. Ereb. & Terr., 1847, p. 93.

Common among rocks along the coast. Colour bright green in life, changing to brown after death. Length to about 30 inches.

81b. G. UNDULATUS. *Muraenophis undulata* Lacep., H. N. Poiss. v, 1803, p. 629, pl. 5, 2. *Muraena cancellata* Rich., Ichth. Ereb. & Terr., 1847, p. 87, pl. 46, 1-5. (Pl. viii.).

A tropical species; its occurrence in these waters needs verification.

81c. G. PICTUS. *Muraena picta* Ahl, Mur. & Ophich. in Thunb., Dissert. iii, 1789, p. 6, pl. 2, 2. *G. pictus* Blkr., Atlas Ichth. iv, 1864, p. 87, pl. 170, 3-4. (Pl. viii.).

Another tropical species unreliably recorded from this State.

81d. G. PRIONODON. *Id.* Ogilby, P.L.S. N.S.W. (2) ix, 1895, p. 720.

The unique type of this species is 12 inches long; the occurrence of the species in these waters requires verification.

[*G. maculaepinnis* Blkr., and *G. (Poecilophis) unicolor* de la Roche, have been recorded from Port Jackson by Steindachner (Sitzb. Akad. Wiss. Wien liii, 1866, pp. 472-473), but neither species occurs in these waters.]

82. ECHIDNA Forster, Icones Ineditae, 1777, p. 181 (*variegata*).

82a. E. NEBULOSA. CLOUDED EEL. *Muraena nebulosa* Ahl, Mur. & Ophich. in Thunb., Dissert. iii, 1789, p. 5, pl. 50, 2; *Id.* Day, Fish. India, 1878, p. 673, pl. 172, 2. (Pl. viii.).

A tropical species; its occurrence in these waters needs verification.

L.

Family ECHELIDAE.

A. Pectoral fins well developed.

Myrophis (83).

AA. No pectoral fins.

Muraenichthys (84).

83. MYROPHIS Lutken, Vid. Meddel. Nat. Foren. Kjobenhavn, 1851, p. 1 (*punctatus*).

83a. ? M. AUSTRALIS. *Id.* Castelnau, P.L.S. N.S.W. iii, 1879, p. 396.

Only one specimen of this species has been recorded. Its affinities are uncertain. Length 34 inches.

84. MURAENICHTHYS Blkr., Nat. Tijd. Ned. Ind. iv, 1853, p. 506 (*gymnopterus*).

84a. M. AUSTRALIS. WORM EEL. *Id.* Macleay, P.L.S. N.S.W. vi, 1881, p. 272. *Id.* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 20, fig. 6.

* An uncommon species which is very slender, and less than 12 inches long.

LI

Family OPHICHTHYIDAE.

- A. Snout produced, beak-like; dorsal commencing behind pectorals. *Ophisurus* (85).
 AA. Snout shorter; dorsal commencing before pectorals. *Bascanichthys* (86).

85. OPHISURUS Lacep., H. N. Poiss. ii, 1800, p. 195 (*serpens*).

- 85a. O. SERPENS. SNAKE EEL. *Muraena serpens* Linn., Syst. Nat. 10th ed.
 1758, p. 244. *O. serpens* Schlegel, Faun. Japon., Pisces, 1850, p. 264, pl.
 115, 1. (Pl. viii.).

Widely distributed, and reaching nearly 5 feet in length.

86. BASCANICHTHYS Jord. & Davis, Rep. U.S. Fish. Comm. 1888 (1892), p. 621 (*bascanium*)

- 86a. B. PINGUIS. *Ophichthys pinguis* Gthr., A.M.N.H. (4), x, 1872, p. 245,
 and Cruise Curacoa, 1873, p. 430, pl. 35. (Pl. viii.).

LARVAL EELS.

87. ATOPICHTHYS Garman, Mem. Mus. Comp. Zool. xxvi, p. 326.

- 87a. A.SP. GLASS EEL. *Leptocephalus* sp. Waite, P.L.S. N.S.W. (2) ix,
 1894, p. 225. *Id.* Ogilby, P.L.S. N.S.W. xxii, 1897, pp. 158 and 161, fig.

These are small transparent fishes with minute heads and broad compressed bodies, which are merely the larval stages of eels of various families.

Pipe-fishes, Seahorses, and Bellows-fish.—Order SOLENICHTHYES.

Snout tubiform; body often encased in bony rings.

- A. Ventral fins present; anal well developed, opposite the dorsal.

- B. Jaws with minute teeth; body elongate.

- C. Dorsal fin preceded by free spines.

Family *Aulostomidae* (No. lii.)

- CC. No dorsal spines.

Family *Fistulariidae* (No. liii.)

- BB. Jaws toothless; body deeper. Two dorsal fins, the first formed of strong spines.

Family *Macrorhamphosidae* (No. liv.)

- AA. No ventral fins; anal minute or absent.

Family *Syngnathidae* (No. lv.)

LII.

Family AULOSTOMIDAE.

88. AULOSTOMUS Lacep., H. N. Poiss., v, 1803, p. 356 (*chinensis*).

- 88a. A. CHINENSIS. PAINTED FLUTE-MOUTH. *Fistularia chinensis* Linn.,
 Syst. Nat. 12th ed., i, I, 1766, p. 515. *A. chinense* Gthr., Fisch. Sudsee vii,
 1881, p. 221, pl. 123, b-c. (Pl. ix.).

A tropical species. One specimen found on Maroubra beach, near Sydney, July, 1912.

LIII.

Family FISTULARIIDAE.

89. FISTULARIA Linn., Syst. Nat. 10th ed., 1758, p. 312 (*tabacaria*).

- A. Interorbital space concave; mediolateral ridges of snout parallel anteriorly.

petimba (89a).

- AA. Interorbital space almost flat; mediolateral ridges of snout expanding anteriorly to enclose an elongate-ovoid space.

depressa (89b).

89a. F. PETIMBA. FLUTE-MOUTH. *Id.* Lacep., H. N. Poiss. v, 1803, p. 349.

- F. serrata* Gthr., Chall. Zool. i, 1880, p. 68, pl. 32, c—snout; *Id.*
 Day, Fish., India, 1876, p. 360, pl. 76, 3 (Pl. ix.).

Common in estuaries along the coast and reaching a length of about three feet. Colour dark green or brown.

89b. F. DEPRESSA. DEEP-SEA FLUTE-MOUTH. *Id. Gthr.*, Chall. Zool. i, 1880, p. 69, pl. 32, d—snout.

Restricted to deeper water. Colour pinkish.

LIV.

Family MACRORHAMPHOSIDAE.

90. MACRORHAMPHOSUS Lacep., H. N. Poiss. v, 1803, p. 136 (*cornutus*).

A. Depth more than half the head-length; dorsal spine over or a little before the vent. *elevatus* (90a).

AA. Depth less than half the head-length; dorsal spine well before the vent. *gracilis* (90b).

90a. M. ELEVATUS. BELLOWS FISH. *M. scolopax* var. *elevatus* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 59, pl. 7.1. (Pl. ix).

Plentiful in deep water and very variable in proportional details. Length 5½ inches.

90b. M. GRACILIS. LITTLE BELLOWS FISH. *Centriscus gracilis* Lowe, P.Z.S. 1839, p. 86. *M. gracilis* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 61, pl. 7, 2.

Widely distributed. Length 4 inches.

LV.

Family SYNGNATHIDAE.

A. Caudal fin present though sometimes rudimentary.

B. Pectoral fin present.

C. Dorsal fin opposite or near the vent.

D. Dorsal edges of trunk and tail not continuous.

E. Operculum crossed by a horizontal ridge. *Corythoichthys* (91)

EE. Operculum without a horizontal ridge except anteriorly. *Syngnathus* (92).

DD. Dorsal edges of trunk and tail continuous. *Ichthyocampus* (93).

CC. Dorsal fin far behind the vent. *Urocampus* (94).

BB. No pectoral fins. *Nannocampus* (95).

AA. No caudal fin.

F. Body broader than deep.

G. Tail longer than head and trunk; snout slender. *Stigmatopora* (96).

GG. Tail shorter than head and trunk; snout broad. *Syngnathoides* (97).

FF. Body deeper than broad.

H. Dorsal largely or entirely behind the vent; axis of head at an oblique angle to that of body.

I. Shields of head, body, and tail with elongate processes bearing leaf-like appendages. *Phyllopteryx* (98).

II. Shields without such processes, prickly. *Solegnathus* (99).

HH. Dorsal largely before the vent; axis of head more or less at a right angle to that of the body. *Hippocampus* (100).

91. CORTHOICHTHYS Kaup. Arch. Naturg. xix. i, 1853, p. 231 (*albirostris*).

Perhaps synonymous with *Hippichthys* Bleeker.

A. Snout shorter than postorbital portion of head.

parviceps (91a).

AA. Snout longer than postorbital portion of head.

B. Dorsal entirely behind the vent.

altirostris (91b).

BB. Vent below anterior portion of dorsal.

margaritifera (91c).

91a. C. PARVICEPS. *Syngnathus parviceps* Ramsay and Ogilby, P.L.S.N.S.W. (2) i, 1886, p. 475.

91b. C. ALTIROSTRIS. *Syngnathus altirostris* Ogilby, Rec. Austr. Mus. i, 1890, p. 55.

- 91c. *C. MARGARITIFER* *Syngnathus margaritifer* Peters, Mb. Akad. Berlin, 1868, p. 457.
92. *SYNGNATHUS* Linn., Syst. Nat. 10th ed., 1758, p. 336 (*acus*).
- A. Snout as long as postorbital portion of head; a filament above each eye. *superciliaris* (92a).
- AA. Snout longer than postorbital portion of head; no filament above the eye. *tigris* (92b).
- 92a. *S. SUPERCILIARIS*. *Id.* Gthr., Challenger Zool. i, 1880, p. 30.
- 92b. *S. TIGRIS*. PIPEFISH. *Id.* Castelnau, P.L.S.N.S.W. iii, 1879, p. 397.
Id. McCulloch, Rec. W. Austr. Mus. i, 2, 1912, p. 83, pl. 11, 2 (Pl. ix).
The largest of the genus occurring in New South Wales. Length 11 inches.
93. *ICHTHYOCAMPUS* Kaup, Arch. Naturg. xix. i, 1853, p. 231 (*belcheri*).
- A. Snout much longer than postorbital portion of head. *cinctus* (93a).
- AA. Snout much shorter than postorbital portion of head. *filum* (93b).
- 93a. *I. CINCTUS*. *Syngnathus cinctus* Ramsay, P.L.S.N.S.W., vii., 1882, p. 111.
- 93b. *I. FILUM*. *Id.* Gthr., Brit. Mus. Cat. Fish. viii, 1870, p. 178; *Id.* McCull., Rec. Austr. Mus. vii, 1909, p. 318, pl. 90, 1 (Pl. ix).
A diminutive species not uncommon in rock-pools on the coast. Length 3½ inches.
94. *UROCAMPUS* Gthr., Brit. Mus. Cat. Fish. viii, 1870, p. 179 (*nanus*).
- 94a. *U. CARINIROSTRIS*. *Id.* Castelnau, P.Z.S. Vict. i, 1872, p. 201; *Id.* McCulloch, Rec. Austr. Mus. vii, 1909, p. 317, pl. 90, 2 (Pl. ix).
Common on *Zostera* flats in Port Jackson. Length about 4 inches.
95. *NANNOCAMPUS* Gthr., Brit. Mus. Cat. Fish. viii, 1870, p. 178 (*subosseus*).
- 95a. *N. RUBER*. *Id.* Rams. and Ogilby, P.L.S.N.S.W. x, 1886, p. 757.
Known only from the typical specimen. Length 4½ inches.
96. *STIGMATOPORA* Kaup, Arch. Naturg. xix. i, 1853, p. 233 (*argus*).
- A. Vent below or before middle of dorsal fin; D. 48-55. *argus* (96a).
- AA. Vent behind middle of dorsal fin; D. 36-43. *nigra* (96b).
- 96a. *S. ARGUS*. SPOTTED PIPEFISH. *Syngnathus argus* Rich., Proc. Zool. Soc. 1840, p. 29, and Tr. Zool. Soc. iii, 1849, p. 183, pl. 8, 2 (Pl. ix).
Very common in Sea-grass, and ornamented with small black white-edged ocelli on a green ground colour. Length 7 inches.
- 96b. *S. NIGRA*. *Id.* Kaup, Brit. Mus. Cat. Lophobr., 1856, p. 53; *Id.* McCulloch, Austr. Zool. i, 1, 1914, p. 29, fig. 1-3 (Pl. ix).
97. *SYNGNATHOIDES* Bleeker, Nat. Tijds. Ned. Ind. ii, 1851, p. 259 (*blochi*).
- 97a. *S. BIACULEATUS*. *Syngnathus biaculeatus* Bloch, Ausl. Fisch. iv, 1785, p. 10, pl. 121, 1-2. *Gastrotekeus biaculeatus* Day, Fish. India, 1878, p. 681, pl. 174, 5 (Pl. ix).
A tropical species. Length about 10 inches.
98. *PHYLLOPTERYX* Swainson, Nat. Hist. Fish. &c. ii, 1839, p. 332 (*foliatus*).
- 98a. *P. FOLIATUS*. LEAFY SEAHORSE. *Syngnathus foliatus* Shaw, Gen. Zool. v, 1804, p. 456, pl. 180. *P. foliatus* McCoy, Prodr. Zool. Vict. dec. vii, 1882, pl. 65, 1 (Pl. x).

An ornate species which is not uncommon, and is usually found washed up on beaches after storms. Length 16 inches.

99. SOLEGNATHUS Swainson, Nat. Hist. Fish. &c. ii, 1839, p. 333 (*hardwickii*).
 A. Dorsal edges of body and tail continuous. *hardwickii* (99a).
 AA. Mediolateral ridge of body continuous with the dorsal edge of the tail.
 B. Scutes convex and intensely spiny. *spinosissimus* (99b).
 BB. Scutes flatter, rugose, with one spine. *fasciatus* (99c).

- 99a. S. HARDWICKII. *Syngnathus hardwickii* Gray, Illustr. Ind. Zool., 1830, pl. 6, 3. *Solenognathus hardwickii* Waite, P.L.S.N.S.W. (2) ix, 1894, p. 221, pl. 17, 2-4-7.

A tropical species, not common in this State. Length 18 inches.

- 99b. S. SPINOSISSIMUS. SPINY SEAHORSE. *Id.* Gthr., Brit. Mus. Cat. Fish viii, 1870, p. 195; *Id.* Waite, P.L.S.N.S.W. (2) ix, 1894, p. 222, pl. 17, 5-8.

Not uncommonly washed up on coastal beaches after storms. Length 18 inches.

- 99c. S. FASCIATUS. *Id.* Gthr., Challenger Zool. i, 1880, p. 30, pl. 14, b (Pl. ix).

Perhaps synonymous with the preceding species.

100. HIPPOCAMPUS Rafinesque, Carrat. Gen. Spec. Sicilia, 1810, p. 18 (*hippocampus*).

- A. Dorsal with 28-31 rays. *abdominalis* (100a).
 AA. Dorsal with less than 21 rays.
 B. Snout at least half as long as the head. *novae-hollandiae* (100b).
 BB. Snout less than half the length of the head. *breviceps* (100c).

- 100a. H. ABDOMINALIS. SEAHORSE. *Id.* Lesson in Ferussac, Bull. Sci. Nat. xi, 1827, p. 127; *Id.* McCulloch, Zool. Res. Endeavour i, 1, 1911, p. 29, pl. 6, 1-2 (Pl. x).

Our largest species of the genus. Length about 10 inches when extended.

- 100b. H. NOVAE-HOLLANDIAE. SEAHORSE. *Id.* Steindachner, Sb. Akad. Wiss. Wien liii, 1866, p. 474, pl. 1, 2 (Pl. x).

Common among weeds in Port Jackson.

- 100c. H. BREVICEPS. SHORT-SNOURED SEAHORSE. *Id.* Peters, Mb. Akad. Berlin 1869, p. 710; *Id.* McCoy, Prodr. Zool. Viet. dec. vi, 1882, pl. 55, 2.

Ogilby's record of this southern species from Port Jackson requires verification. No specimen from this State is in the Australian Museum.

Dragon Fishes—Order HYPOSTOMIDES.

Body encased in bony rings. Snout produced but not tubuliform.

LVI. Family PEGASIDAE.

- A. Tail shorter, quadrangular posteriorly. *Pegasus* (101).
 AA. Tail longer, flattened posteriorly. *Parapegasus* (102).

101. PEGASUS Linn., Syst. Nat. 10th ed., 1758, p. 338 (*volitans*).

- 101a. P. VOLITANS. DRAGON FISH. *Id.* Linn., *Op. cit.* *Zalises umitengu* Jord. & Snyder, P.U.S. Nat. Mus. xxiv, 1901, p. 2, pl. 1, 2 (Pl. x).

A single specimen from Port Jackson, having nine rays in each pectoral fin, has been called *P. pauciradiatus* by Ogilby. Length 2 inches.

102. *PARAPEGASUS* Dumeril, Hist. Nat. Poiss. ii, 1870, p. 492 (*natans*).

102a. P. NATANS. *Pegasus natans* Linn., Syst. Nat. 12th ed. i, 1766, p. 418.
Parapegasmus natans McCulloch, Biol. Res. Endeavour iii, 3, 1915, p. 110,
 fig. 2 (Pl. x).

Two specimens are in the Australian Museum from Lake Macquarie and Tuggerah Lakes. Length 5 inches.

Garfish, Flying Fish, and Long Tom.—Order SYNENTOGNATHI.

Fins without spines. Ventral fins abdominal. Lateral line forming a raised ridge along the lower surface of the body.

A. Dorsal and anal fins followed by several detached finlets; both jaws produced into a beak. Family *Scomberesocidae* (No. lvii).

AA. No detached finlets behind the dorsal and anal fins.

B. Both jaws produced into a long toothed beak. Family *Belonidae* (No. lviii).

BB. Jaws either equally short or only the lower jaw produced.

C. Jaws short, subequal; pectoral fins enlarged for flight.

Family *Exocoetidae* (No. lix).

CC. Lower jaw more or less produced into a beak; pectoral fins usually short

Family *Hemirhamphidae* (No. lx).

LVII. Family SCOMBERESOCIDAE.

103. SCOMBERESOX Lacep., H. N. Poiss. v, 1803, p. 344 (*camperi*).

103a. S. FORSTERI. BILL-FISH. *Id.* Cuv. & Val., H. N. Poiss. xviii, 1846, p.
 481. *Scomberesox saurus* var. *forsteri* McCoy, Prodr. Zool. Viet. dec. xiv,
 1887, pl. 135, 2 (Pl. ix).

A pelagic species occasionally occurring in shoals. Length 15 inches.

LVIII. Family BELONIDAE.

A. Body little compressed, its breadth more than two-thirds its greatest depth.

Tylosurus (104).

AA. Body much compressed, its breadth less than half its greatest depth.

Athlennes (105).

104. TYLOSURUS Cocco, Giorn. Sci. Lett. Sicilia xlii No. 24, 1833, p. 18 (*cantrainii*).

A. Caudal peduncle as broad as deep.

B. Anal with 25-26 rays.

ferox (104a).

BB. Anal with 19-21 rays.

macleayana (104b).

AA. Caudal peduncle much deeper than broad.

krefftii (104c).

104a. T. FERON. SLENDER LONG TOM. *Belone ferox* Gthr., Brit. Mus. Cat. Fish. vi, 1866, p. 242. *T. ferox* Stead, Ed. Fish. N.S. Wales, 1908, p. 34, Pl. 10.

A very voracious species, common on the coast. Length 3 feet.

104b. T. MACLEAYANA. STOUT LONG TOM. *Belone macleayana* Ogilby, Cat. Fish. N.S. Wales, 1886, p. 53. *T. macleayana* Stead, Ed. Fish. N.S. Wales, 1908, p. 35, pl. 10 (Pl. ix).

Abundant in estuaries and coastal waters. Length to 4 feet.

104c. T. KREFFTII. *Belone krefftii* Gthr., Brit. Mus. Cat. Fish. vi, 1866, p. 250.

A little known species which has been recorded from this State on unreliable authority.

105. ATHLENNES Jordan & Fordyce, P.U.S. Nat. Mus. ix, 1886, p. 345 (*hians*).

105a. A. CAERULEOFASCIATUS. BARRED LONG TOM. *Tylosurus caeruleofasciatus* Stead, New Fish N.S. Wales (Fish. Dept. N.S. Wales), 1908, p. 3, pl. 1. A. *caeruleofasciatus* Ogilby, Mem. Qld. Mus. v, 1916, p. 130, pl. 14 (Pl. x).

Characterised by the compressed body which bears several dark vertical bars on the sides. Not common. Length 2 feet.

LIX. Family EXOCOETIDÆ.

A. Ventral fins shorter, inserted nearer tip of snout than base of tail.

Exocoetus (106).

AA. Ventral fins enlarged, inserted nearer base of tail than tip of snout.

Cypselurus (107).

106. EXOCOETUS Linn., Syst. Nat. 10th ed., 1758, p. 316 (*volitans*).

106a. E. EVOLANS. FLYING FISH. *Id.* Linn., Syst. Nat. 12th. ed., 1766, p. 521; *Id.* Day, Fish India, 1877, p. 519, pl. 120, 5 (Pl. x).

Widely distributed over temperate and tropical seas. Length about 12 inches.

107. CYPSELURUS Swainson, Nat. Hist. Fish. &c., ii, 1839, p. 296 (*nutalli*).

A. Anal fin commencing below dorsal origin.

B. Pectoral with a light median band.

speculiger (107a).

BB. Pectoral without a light median band.

cribrosus (107b).

AA. Anal fin commencing opposite middle of dorsal.

melanocercus (107c).

107a. C. SPECULIGER. FLYING FISH. *Exocoetus speculiger* Cuv. & Val., Hist. Nat. Poiss. xix, 1846, p. 94. C. *speculiger* Jordan & Seale, Bull. U.S. Bur. Fish. xxv, 1906, p. 209, fig. 13.

107b. C. CRIBROSUS. FLYING FISH. *Exocetus unicolor vel cribrosa* Kner., Reise Novara, Zool. i, 1867, p. 325. C. *cribrosus* McCulloch, Mem. Qld. Mus. v, 1916, p. 59, pl. 7 (Pl. x).

Occasionally flies aboard ships on the coast. Length about 12 inches.

107c. C. MELANOCERCUS. LARGER FLYING FISH. *Exocoetus melanocercus* Ogilby, P.L.S.N.S.W. x, 1885, p. 123.

A rather rare species, only known from the coast near Sydney. Length 16 inches.

LX. Family HEMIRHAMPHIDÆ.

A. Lower jaw produced into a long beak.

B. Pectoral fins short, body moderately compressed.

Hemirhamphus (108).

BB. Pectoral fins long; body much compressed.

Euleptorhamphus (109).

AA. Lower jaw forming only a short beak.

Arrhamphus (110).

108. HEMIRHAMPHUS Cuvier, Regne Anim. ii, 1817, p. 186 (*brasiliensis*).

A. Origin of anal fin almost opposite that of the dorsal.

B. Ventral origin nearer the hypural joint than the gill-opening.

intermedius (108a).

H. *australis* is apparently allied to H. *intermedius*.

BB. Ventral origin nearer the gill-opening than the hypural joint.

regularis (108c).

AA. Origin of anal fin almost opposite the middle of the dorsal.

fur (108d).

- 108a. *H. INTERMEDIUS*. SEA GARFISH, BEAKIE. *Id.* Cantor, A.M.N.H. ix, 1842, p. 485; *Id.* McCoy, Prodr. Zool. Viet. dec. xiv, 1887, pl. 135, 1 (Pl. ix).

One of our most valuable food-fishes, occurring in schools. Length 18 inches.

- 108b. *H. AUSTRALIS*. *Id.* Steindachner, Sitzb., Akad. Wiss. Wien, liii, 1866, p. 471.

This species has not been recognised since it was first described.

- 108c. *H. REGULARIS*. RIVER GARFISH. *Id.* Gthr., Brit. Mus. Cat. Fish. vi, 1866, p. 261; *Id.* Stead, Ed. Fish. N.S. Wales, 1908, p. 37, pl. 11.

An important food-fish, and one of the principal species of the fish markets. Abounds in coastal lakes, harbours and estuaries. Length 14 inches.

- 108d. *H. FAR*. BARRED GARFISH. *Esox far* Forsk., Descr. Anim., 1775, p. 67. *H. far* Day, Fish. India, 1877, p. 516, pl. 120, 3.

A northern species common at times. Length 15 inches.

H. gaimardii Cuv. & Val., H. N. Poiss. xix, 1846, p. 36, was said to have been taken in Port Jackson by Quoy and Gaimard, and *H. argenteus* Bennett, has been recorded from Sydney by Castelnau, P.L.S.N.S.W. iii, 1879, p. 394. The first is a tropical species, and its occurrence here needs verification. The second is a little known species, and no reliance can be placed upon Castelnau's identification.

109. *EULEPTORHAMPHUS* Gill, Proc. Acad. Nat. Sci. Philad., 1859, p. 156 (*brevoorti*).

- 109a. *E. LONGIROSTRIS*. Long-beaked Garfish. *Hemirhamphus longirostris* Cuvier, Regne Anim. 2nd ed. ii, 1829, p. 286; *Id.* Valenciennes, R. Anim. Illustr. Poiss., 1849, pl. 98, 2 (Pl. x).

Only once recorded from this State. A pelagic species. Length 18 inches.

110. *ARRHAMPHUS* Gthr., Brit. Mus. Cat. Fish. vi, 1866, p. 276 (*sclerolepis*).

- 110a. *A. SCLEROLEPIS*. SHORT-BEAKED GARFISH. *Id.* Gthr., *Tom. cit.*, p. 277. *Hemirhamphus krefftii* Steindachner, Sb. Akad. Wiss. Wien lvi. i, 1867, p. 332, pl. 1, 1-2 (Pl. x).

A northern species, abundant in the Richmond and Clarence estuaries. Length 15 inches.

Beardie and Rat-tails.—Order ANACANTHINI.

Vertical fins without true spines, though some anterior rays are often spiniform. Ventrals jugular, without spines.

A. Caudal fin well developed, distinct from the dorsal and anal fins; tail not greatly elongate. Family *Gadidae* (No. lxi).

AA. Caudal fin either absent or united with the dorsal and anal rays; tail very long, tapering posteriorly. Family *Coryphaenoididae* (lxii).

LXI. Family GADIDAE.

A. An outer row of strong teeth in each jaw followed by a narrow band of small ones; scales very small. *Lotella* (111).

AA. Teeth subequal in size, in bands; scales larger.

B. Premaxillary teeth in a single broad band on each side. *Physiculus* (112).

BB. Premaxillary teeth divided into two series on each side by a groove.

Austrophycis (113).

111. LOTELLA Kaup, Arch. Naturg. xxiv. i, 1858, p. 88 (*phycis*).

111a. L. CALLARIAS. BEARDIE. *Id.* Gthr., A.M.N.H. (3) xi, 1863, p. 116. *L. schuettei* Steindachner, Sb. Akad. Wiss. Wien liii, 1866, p. 466, pl. 3, 1 (Pl. xi).

Not uncommon near rocky reefs on the coast, and regarded as of some value as a food-fish. Length 20 inches.

L. fuliginosa Gthr., has been included in New South Wales lists on the very unreliable authority of Castelnau, who called it *rubiginosa*, but there is no reason to suppose the species occurs here.

112. PHYSICULUS Kaup, Arch. Naturg. xxiv. i, 1858, p. 88 (*dalwigkii*).

A. Ventrals narrow at base; snout shorter than eye.

bachus (112a).

AA. Ventrals broader at base; snout longer than eye.

barbatus (112b).

112a. P. BACHUS. RED COD. *Enchelyopus bachus* (Forster) Bloch & Schneider, Syst. Ichth. 1801, p. 53. *Lota breviscula* Rich., Ichth. Erebus & Terror, 1846, p. 61, pl. 38, 1-2 (Pl. xi).

Rare in New South Wales. Length about 15 inches.

112b. P. BARBATUS. ROCK COD. *Pseudophycis barbatus* Gthr., A.M.N.H. (3) xi, 1863, p. 116; *Id.* McCoy, Prodr. Zool. Viet. dec. ii, 1878, pl. 20.

A southern species, extending into the waters of this State in the cooler months. Length 17 inches. I have examined the specimen figured by Stead, Ed. Fish. N.S. Wales, 1908, pl. 16, as *P. bachus*, and identify it as *P. barbatus*; it is from Merimbula.

113. AUSTROPHYCIS Ogilby, P.L.S.N.S.W. xxii, 1897, p. 90 (*megalops*).

113a. A. MEGALOPS. *Id.* Ogilby, *Tom. cit.*, p. 91.

This species is only known from the typical example which is in a very imperfect state of preservation. Length 3 inches.

LXII Family CORYPHAENOIDIDAE.

A. Dorsal spine serrated; 7 branchiostegal rays; snout obtuse. *Lionurus* (114).

AA. Dorsal spine smooth; 6 branchiostegal rays.

B. Snout produced, pointed; teeth small.

Coelorhynchus (115).

BB. Snout short, obtuse; some premaxillary teeth enlarged. *Optonurus* (116).

114. LIONURUS Gthr., Challenger Zool. xxii, 1887, pp. 124, 141 (*filicauda*).

114a. L. NIGROMACULATUS. RAT-TAIL. *Macrourus nigromaculatus* McCulloch, Rec. Austr. Mus. vi. 5, 1907, p. 346, pl. 63, 1 (Pl. xi).

Four specimens dredged in deep water off Sydney. Length 9 inches.

115. COELORHYNCHUS Giorna, Mem. Acad. Eci. Torino xvi, 1805, p. 178 (*Coelorhynche la ville*).

A. Snout greatly produced, longer than the eye.

innotabilis (115a).

AA. Snout shorter than the eye.

fasciatus (115b).

115a. C. INNOTABILIS. *Id.* McCulloch, Rec. Austr. Mus. vi. 5, 1907, p. 348, pl. 63, 2 (Pl. xi).

Known only from the typical specimens from deep water. Length 5½ inches.

115b. C. FASCIATUS. *Id.* Gthr., Challenger Zool. xxii, 1887, p. 129, pl. 28, a (Pl. xi).

Widely distributed in deep water between South America and Australia. Length 8 inches.

116. *OPTONURUS* Gthr., Challenger Zool. xxii, 1887, pp. 124, 147 (*denticulatus*).
 116a. *O. DENTICULATUS*. *Macrourus denticulatus* Rich., Ichth. Erebus & Terror,
 1846, p. 53, pl. 32, 1-3 (Pl. xi).

Inhabits deep water. Length 15 inches.

Nannygai, Knight Fish. and John Dory.—Order BERYCOMORPHI.

- A. Dorsal spines increasing in length backward, forming a single fin with the rays.
 B. V.i/7, anal with 4 spines. Family *Berycidae* (No. lxiii).
 BB. V.i/6, anal with 2-3 spines. Family *Trachichthyidae* (No. lxiv).
 AA. Dorsal spines decreasing in length posteriorly, and forming a portion of the
 fin distinct from that of the rays.
 C. Body enveloped in thick bony scutes; V.i/3. Family *Monocentridae* (No. lxv).
 CC. Body with small scales or naked; V.i/5—i/6. Family *Zeidae* (No. lxvi).

LXIII. Family BERYCIDAE.

117. *TRACHICHTHODES* Gilchrist, Mar. Invest. S. Africa ii, 1903, p. 203 (*spinosus*).
 117a. *T. AFFINIS*. NANNYGAL. *Beryx affinis* Gthr., Brit. Mus. Cat. Fish. i,
 1859, p. 13. *Hoplopteryx affinis* Regan, A.M.N.H. (8) vii, 1911, p. 5,
 pl. 1 (Pl. xii).

Abundant in deep water off the coast, and often taken on lines around rocky reefs. Remarkable for its iridescent pink colouration. Length 18 inches.

LXIV. Family TRACHICHTHYIDAE.

- A. Vent far behind the ventral fins.
 B. Dorsal with 3, anal with 2 spines, the fins covered with asperities. *Trachichthys* (118).
 BB. Dorsal with 4-7, anal with 3 spines, the fins not covered with asperities.
Hoplostethus (119).
 AA. Vent placed between the ventrals. *Paratrachichthys* (120).

118. *TRACHICHTHYS* Shaw & Nodder, Nat. Miscell. x, 1799, p. 378 (*australis*).
 118a. *T. AUSTRALIS*. ROUGHY. *Id.* Shaw & Nodder, *Tom. cit. Id.* McCoy,
 Prodr. Zool. Viet. dec. xii, 1886, pl. 114 (Pl. xii).
 A small rugose fish inhabiting rocky reefs. Length about 6 inches.

119. *HOPLOSTETHUS* Cuv. & Val. H. N. Poiss. iv, 1829, p. 469 (*mediterraneus*).
 A. 4 dorsal spines; depth about 3 in the length. *elongatus* (119a).
 AA. 6 dorsal spines; depth about 2 and 1 third in the length. *intermedius* (119b).

- 119a. *H. ELONGATUS*. *Trachichthys elongatus* Gthr., Brit. Mus. Cat. Fish. i,
 1859, p. 10, and Challenger Zool. xxii, 1887, p. 22, pl. 5, e.
 A very rare deep-water species. Length 5 inches.

- 119b. *H. INTERMEDIUS*. *Trachichthys intermedius* Hector, Tr. N. Zeal. Inst. vii,
 1875, p. 245, pl. 11. *H. intermedius* McCulloch, Biol. Res. Endeavour ii,
 3, 1914, p. 100, fig. 6 (Pl. xii).

An inhabitant of deep water. Length about 7 inches.

120. *PARATRACHICHTHYS* Waite, Mem. Austr. Mus. iv., 1, 1899, p. 64 (*trailli*).
 120a. *P. TRAILLI*. SANDPAPER FISH. *Trachichthys trailli* Hutton, Tr. N. Zeal.
 Inst. viii, 1876, p. 212; *Id.* Gthr., Challenger Zool. xxii, 1887, p. 23, pl.
 55, a (Pl. xii).

Common in deep water and often taken by trawlers. Length 10 inches.

LXV.

Family MONOCENTRIDAE.

121. CLEIDOPUS De Vis, P.L.S.N.S.W. vii, 1882, p. 367 (
- gloria-maris*
-).

This genus differs from *Monocentris* in having a patch of vomerine teeth, a luminous organ on each side of the mandible, and the suborbital linear instead of broad.

- 121a. C. GLORIA-MARIS. KNIGHT FISH. *Id.* De Vis, P.L.S.N.S.W. vii, 1882, p. 368. *Monocentris gloria-maris* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 67, pl. 8, 1-2 (Pl. xii).

Not uncommonly taken by trawlers on the coast, and characterised by the presence of "port and starboard lights" on its lower jaw. Length 9 inches.

LXVI.

Family ZEIDAE.

- A. Series of bony plates along the bases of the vertical fins.

B. 4 anal spines, scales evident.

Zeus (122).

BB. 3 anal spines, body naked.

Zenopsis (123).

- AA. No series of bony plates at bases of vertical fins; body scaly.
- Cyttus*
- (124).

122. ZEUS Linn., Syst. Nat. 10th ed. 1758, p. 266 (
- faber*
-).

- 122a. Z. FABER. JOHN DORY. *Id.* Linn., *Tom. cit.*, p. 267; *Id.* Day, Fish. Gt. Brit. & Irel. i, 1880-1884, p. 138, pl. 48 (Pl. xii).

Common in deep water, and prized as a table fish. Length about 2 feet.

123. ZENOPSIS Gill, P.Ac.N.Sci. Philad. 1862, p. 126 (
- nebulosus*
-).

- 123a. Z. NEBULOSUS. MIRROR DORY. *Zeus nebulosus* Schlegel, Faun. Japon. Pisces 1847, p. 123, pl. 66. *Zenopsis nebulosus* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 83, pl. 16, 1 (Pl. xii).

A deep water species taken by trawlers. Remarkable for its silver mirror-like body. Length 14 inches.

124. CYTTUS Gthr., Brit. Mus. Cat. Fish. ii, 1860, p. 396 (
- australis*
-).

- 124a. C. AUSTRALIS. SILVER DORY. *Capros australis* Rich., Tr. Zool. Soc. iii. 1849, p. 72, and Ichth. Erebus & Terror, 1845, p. 137, pl. 59, 1-5 (Pl. xii).

Commonly taken by trawlers in moderate depths. Length 16 inches.

Ribbonfishes.—Order ALLOTRIIGNATHI.

- A. Each ventral fin reduced to a single long filament. Family
- Regalecidae*
- (lxvii).

- AA. Each ventral fin either with several rays or wanting.

Family *Trachipteridae* (No. lxviii).

LXVII.

Family REGALECIDAE.

125. REGALECUS Ascanius Icones rerum Nat. ii, 1772, p. 5 (
- glesne*
-).

- 125a. R. GLESNE. RIBBON FISH, OAR FISH. *Id.* Ascanius, *Op. cit.* *Gymnetrus gladius* Valenciennes, R. Anim. Illustr. Poiss., 1843, p. 149, pl. 69 (Pl. xi).

A specimen 12 feet long was found on a beach in Fort Jackson. This species reaches a length of over 20 feet and is believed to have given rise to several stories of the occurrence of Sea-serpents.

LXVIII. Family TRACHTERIDAE.

126. TRACHTERID Gouan, Hist. Pisc., 1770, p. 104 (*gouani*).126a. T. JACKSONENSIS. RIBBON FISH. *Regalaecus jacksonensis* Ramsay, P.L.S.N.S.W. v, 1881, p. 631, pl. 20 (Pl. xi).

A very rare species, the type of which is 6 feet long. A young example about six inches long, which was picked up on a beach at Newcastle, has been called *T. jacksonensis polystictus* by Ogilby, P.L.S.N.S.W. xxii, 1898, p. 649.

Flounders and Soles.—Order HETEROSOMATA.

Flat asymmetrical fishes, having both eyes on the one side, which is coloured, while the blind side is normally white.

A. Margin of the preoperculum free.

B. Eyes on the left side.

Family *Bothidae* (No. lxix).

BB. Eyes on the right side.

Family *Pleuronectidae* (No. lxx).

AA. Margin of the preoperculum not free.

C. Eyes on the right side.

Family *Soleidae* (No. lxxi).

CC. Eyes on the left side.

Family *Cynoglossidae* (No. lxxii).

LXIX. Family BOTHIDAE.

A. Ventral fins symmetrical and opposite one another on each side of the abdominal ridge. *Pseudorhombus* (127).

AA. Ventral fins unsymmetrical, the left largest and placed on the abdominal ridge.

B. Eyes separated by a narrow bony ridge.

C. Some anterior dorsal rays produced into filaments. *Lophonectes* (128).CC. No anterior filamentous dorsal rays. *Laeops* (129).BB. Eyes separated by a broad scaly interspace. *Platophrys* (130).127. PSEUDORHOMBUS Bleeker, Versl. Akad. Amsterdam xiii, 1862, p. 426 (*polyspilos*).A. Eye separated by a rather broad interspace from the dorsal profile which is not notched on the snout. *arsius* (127a).

AA. Only a narrow space separating the eye from the dorsal profile which is notched on the snout.

B. Scales of upper surface ctenoid. *multimaculatus* (127b).BB. Scales of upper surface cycloid. *tenuirastrum* (127c).

127a. P. ARSIUS. LARGE-TOOTHED FLOUNDER. *Pleuronectes arsius* Buch., Fish. Ganges, 1822, p. 128. *P. russelli* Blkr., Atlas. Ichth. vi, 1870, p. 6, pl. 233, 2 (Pl. xiii).

One of the commonest of our Flat-fishes, and of fine edible quality. Length about 15 inches.

127b. P. MULTIMACULATUS. SMALL-TOOTHED FLOUNDER. *Id.* Gthr., Brit. Mus. Cat. Fish. iv, 1862, p. 427. *Id.* McCulloch, Biol. Res. Endeavour ii. 3, 1914, p. 131, pl. 24 (Pl. xiii).

Commonly confused with the preceding species. Length 16 inches.

127c. P. TENUIRASTRUM. DEEP-WATER FLOUNDER. *Paralichthys tenuirastrum* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 121, pl. 28.

Taken by trawlers in moderately deep water. Length 11 inches.

128. LOPHONECTES Gthr., Challenger Zool. i, 1880, p. 28 (*gallus*).

128a. L. GALLUS. CRESTED FLOUNDER. *Id.* Gthr., *Tom. cit.*, p. 29, pl. 15, b (Pl. xiii).

Plentiful in deep water but of small size. Length about 8 inches.

129. LAEOPS Gthr., Challenger Zool. i, 1880, p. 29 (*parviceps*).

129a. L. PARVICEPS. *Id.* Gthr., *Tom. cit.*, pl. 15, a (Pl. xiii).

A rare species said to have been trawled off Twofold Bay in 120 fathoms.

130. PLATOPHRYS Swainson, Nat. Hist. Fish. &c. ii, 1839, p. 302 (*ocellatus*).

130a. P. SPINICEPS. *Rhomboidichthys spiniceps* Macleay, P.L.S.N.S.W. vi, 1881, p. 127.

Known only from the typical specimen. Length $4\frac{1}{2}$ inches.

LXX.

Family PLEURONECTIDAE.

A. Two ventral fins.

Ammotretis (131).

AA. Only one ventral fin.

Rhombosolea (132).

131. AMMOTRETIS Gthr., Brit. Mus. Cat. Fish. iv, 1862, p. 458 (*rostratus*).

131a. A. ROSTRATUS LONG-SNOURED FLOUNDER. *Id.* Gthr., *Tom. cit.* *Peltorhamphus bassensis* Waite, Rec. Austr. Mus. vi, 1906, p. 198, pl. 34 (Pl. xiii).

A good food-fish, abundant on the southern portion of the coast. Length 12 inches.

132. RHOMBOSOLEA Gthr., Brit. Mus. Cat. Fish. iv, 1862, p. 458 (*monopus*).

132a. R. FLESOIDES. SOUTHERN FLOUNDER. *Id.* Gthr., A.M.N.H. (3) xi, 1863, p. 117. *Id.* Waite, Rec. Austr. Mus. vi, 1906, p. 197, pl. 35 (Pl. xiii).

A southern species not often recognised in this State. Length 12 inches.

(*R. leporina* Gthr., has been incorrectly recorded from Sydney by Kner, Novara Zool. i, 1867, p. 287).

LXXI.

Family SOLEIDAE.

A. Dorsal and anal fins united with the caudal.

Synaptura (133).

AA. Caudal fin separate from the dorsal and anal.

B. Pectoral fin present.

Soleichthys (134).

BB. No pectoral fins.

C. An open pore above the base of each dorsal and anal ray.

Pardachirus (135).

CC. No pores above the bases of the dorsal and anal rays.

Aseraggodes (136).

133. SYNAPTURA Cantor. Cat. Malay. Fish., 1850, p. 222 (Substitute name for *Brachirus* Swainson, which is regarded as preoccupied).

A. Pectoral fins well developed; colouration almost uniform.

nigra (133a).

AA. Pectoral fins rudimentary; body with numerous dark cross-bars.

fasciata (133b).

133a. S. NIGRA. BLACK SOLE. *Id.* Macleay, P.L.S.N.S.W. v, 1880, p. 49;

Id. Waite, Mem. Austr. Mus. iv, 1, 1899, p. 125, pl. 30.

Abundant in estuaries along the coast, and prized as a table fish. Length 14 inches.

133b. S. FASCIATA. MANY-BANDED SOLE. *Id.* Macleay, P.L.S.N.S.W. vii, 1882, p. 14; *Id.* McCulloch, Mem. Qld. Mus. v, 1916, p. 61, pl. 8, 2 (Pl. xiii).

Occurs in moderate depths. Length 8 inches.

(*Æsopia quagga* Kaup, has been recorded from Port Jackson by Castelnau, P.L.S.N.S.W. iii, 1879, p. 392, and *Zebrias zebrius* Tem. & Schlg., is included in a New South Wales list by Stead, Ed. Fish. N.S. Wales, 1908, p. 107. Both identifications are probably incorrect.)

134. *SOLEICHTHYS* Blkr., Act. Soc. Sci. Indo-Neerl. vi, 1859, p. 183 (*heterorhinos*).

134a. *S. MICROCEPHALUS*. SMALL-HEADED SOLE. *Solea microcephala* Gthr., Brit. Mus. Cat. Fish. iv, 1862, p. 466. *Id.* Roughley, Fish. Austr., 1916, p. 176, pl. 61 (Pl. xiii).

A small and uncommon species occurring in estuaries. Length 8 inches.

134b. *S. LINEATUS*. *Solea lineata* Ramsay, P.L.S.N.S.W. vii, 1883, p. 406.

This is perhaps the young of *S. microcephalus* though its colour-marking resembles that of *S. heterorhinos* Blkr., with which species I have previously united it (Mem. Qld. Mus. v, 1916, p. 60).

(*Microbuglossus humilis* Cantor, is erroneously recorded from Sydney by Kner, Novara Zool. i, 1867, p. 288).

135. *PARDACHIRUS* Gthr., Brit. Mus. Cat. Fish. iv, 1862, p. 478 (*marmoratus*).

135a. *P. HEDLEYI*. PEACOCK SOLE. *Id.* Ogilby, Mem. Qld. Mus. v, 1916, p. 144, pl. 17 (Pl. xiii).

A littoral and not uncommon species. Length 6 inches.

136. *ASERAGGODES* Kaup, Arch. Naturg. xxiv. i, 1858, p. 103 (*guttulatus*).

136a. *A. MACLEAYANUS*. NARROW-BANDED SOLE. *Solca macleayana* Ramsay, P.L.S.N.S.W. v. 4, 1881, p. 462. *A. macleayanus* Ogilby, Mem. Qld. Mus. v, 1916, p. 137, pl. 15 (Pl. xiii).

Not uncommon in depths down to 20 fathoms. Length 11 inches.

LXXII.

Family CYNOGLOSSIDAE.

A. 2 lateral lines on left side, 1 on right.

Paraplagusia (137).

AA. No lateral line.

Symphurus (138).

137. *PARAPLAGUSIA* Blkr., Nat. Tijd. Dierk. ii, 1865, p. 274 (*bilineata*).

137a. *P. UNICOLOR*. TONGUE SOLE. *Plagusia unicolor* Macleay, P.L.S.N.S.W. vi, 1881, p. 138. *Symphurus unicolor* Stead, Ed. Fish. N.S. Wales, 1908, p. 107, pl. 74 (Pl. xiii).

Common on sandy bottoms in shallow depths. Length 13 inches.

138. *SYMPHURUS* Rafinesque, Indice Itiol. Sicil., 1810, p. 52 (*nigrescens*).

138a. *S. AUSTRALIS*. *S. strictus* var. *australis* McCulloch, Rec. Austr. Mus. vi. 5, 1907, p. 349, fig. 55.

Known only from the typical specimen, 5 inches long, which was dredged in deep water off Sydney.

Order PERCOMORPHI.

A large and varied group which includes about half the bony fishes of the State. The dorsal fin is preceded by a greater or smaller number of spines, and the ventral fins have never more than one spine and five rays.

Mullet, Hardyhead, and Sea Pike. Suborder PERCESOCES or MUGILOIDEA.

Two dorsal fins, the first formed of spines. Ventral fins abdominal. Opercles unarmed.

A. No lateral line; teeth small or wanting.

B. Anal fin with 2-3 spines.

BB. Anal fin with 1 spine.

AA. Lateral line present; teeth very strong

Family *Mugilidae* (No. lxxiii).

Family *Atherinidae* (No. lxxiv).

Family *Sphyraenidae* (No. lxxv).

LXXIII.

Family MUGILIDAE.

- A. No teeth on the palate. *Mugil* (139).
 B. Eye with an adipose lid. Subg. *Mugil*.
 BB. Eye without an adipose lid. Subg. *Liza*.
 AA. Minute teeth present on vomer and palatines.
 C. Jaws with teeth.
 D. Teeth of upper jaw well developed, in a single row. *Myxus* (140).
 DD. Teeth of upper jaw minute, in a narrow band. *Agonostomus* (141).
 CC. Jaws toothless. *Trachystoma* (142).
 139. MUGIL Linn., Syst. Nat. 10th ed., 1758, p. 316 (*cephalus*).
 A. Eye partly covered by a transparent adipose lid. Subg. *Mugil*.
 B. 8 anal rays; about 40 scales in a longitudinal row. *cephalus* (139a).
 BB. 9 anal rays; 30-32 scales in a longitudinal row.
 C. End of maxilla hidden by preorbital when mouth is closed; first dorsal spine not reaching half its distance from base of last dorsal ray. *georgii* (139b).
 CC. End of maxilla exposed when mouth is closed; first dorsal spine reaching more than half its distance from base of last dorsal ray. *dussumieri* (139c).
 AA. Eye naked, without a transparent adipose lid. Subg. *Liza*.
 D. Less than 30 scales in a longitudinal row.
 E. 8 anal rays. *waigiensis* (139d).
 EE. 9 anal rays. *compressus* (139e).
 DD. More than 30 scales in a longitudinal row; 10 anal rays.
 F. No enlarged axillary scale; 35-38 scales in a row. *argenteus* (139f).
 FF. An enlarged axillary scale; 39-40 scales in a row. *australis* (139g).

- 139a. *M. CEPHALUS*. SEA MULLET. *Id.* Linn., Syst. Nat. 10th ed., 1758, p. 316. *M. dobula* Gthr., Brit. Mus. Cat. Fish. iii, 1861, p. 420, and Fisch. Sudsee vi, 1877, p. 214, pl. 120, a (Pl. xiv).

Exceedingly abundant, and the commonest fish of the markets. Length, 30 inches. A comparison of local specimens with others from the Adriatic reveals nothing to distinguish the Australian representatives of this widely distributed species, which apparently ranges over all temperate and tropical seas. *M. hypselosoma* Ogilby, P.L.S.N.S.W. xxii, 1897, p. 74, is evidently based upon unusually deep examples of *M. cephalus*.

- 139b. *M. GEORGI*. SILVER MULLET. *Id.* Ogilby, P.L.S.N.S.W. xxii, 1897, p. 77.

A small species, plentiful in northern waters, and becoming rarer southwards. Length 10 inches.

- 139c. *M. DUSSUMIERI*. GREEN-BACKED MULLET. *Id.* Cuvier & Valenciennes, Hist. Nat. Poiss. xi, 1836, p. 147; *Id.* Day, Fish. India, 1876, p. 352, pl. 74, 4.

A tropical species, once recorded from the Clarence River estuary, but the specific identity of the specimens was not satisfactorily determined.

- 139d. *M. WAIGIENSIS*. DIAMOND-SCALED MULLET. *Id.* Quoy & Gaimard, Voy. Uranie, 1825, p. 337, pl. 59, 2; *Id.* Gthr., Fisch. Sudsee vi, 1877, p. 216, pl. 121, b (Pl. xiv).

A tropical species, recorded from the Clarence River estuary. Length 12 inches.

- 139e. *M. COMPRESSUS*. *Id.* Gthr., Brit. Mus. Cat. Fish. iii, 1861, p. 451, and Fisch. Sudsee vii, 1881, p. 217, pl. 123, a (Pl. xiv).

A tropical species, twice recorded from N.S. Wales waters, but further proof of its occurrence here is desirable. It is perhaps synonymous with *M. troschelii* Bleeker.

- 139f. *M. ARGENTEUS*. FLAT-TAILED MULLET. *Id.* Quoy & Gaimard, Voy. Uranie, 1825, p. 338, pl. 59, 3. *M. peronii* Stead, Ed. Fish. N.S. Wales, 1908, p. 42, pl. 13 (Pl. xiv).

An important food-fish, inhabiting the inlets along the coast. Length 18 inches.

- 139g. *M. AUSTRALIS*. *Id.* Steindachner, Denk. Akad. Wiss. Wien xli. i, 1879, p. 6.

A little known species which has not been recognised since it was first described.

(*M. longimanus* was included in a N.S. Wales list by Ogilby, Cat. Fish. N.S. Wales, 1886, p. 41, on the supposition that Steindachner had recorded it from Port Jackson; Waite also listed the species as *M. cunnesius*. But Steindachner's specimen came from Queensland, and the species is not known from New South Wales).

140. *MYXUS* Gthr., Brit. Mus. Cat. Fish. iii, 1861, p. 466 (*elongatus*).

- 140a. *M. ELONGATUS*. TALLEGALANE OR SAND MULLET. *Id.* Gthr., *Tom. cit.*; *Id.* Waite, Tr. Roy. Soc. S. Austr., xl, 1916, p. 454, pl. xlv. (Pl. xiv).

Abundant along the coast. Length 15 inches. *Mugil crenidens* Kner, Novara Zool. i, 1865, p. 229, pl. 9, 4, is apparently synonymous with this species.

141. *AGONOSTOMUS* Bennett, Proc. Zool. Soc. 1830 (1832), p. 116 (*telfairii*).

- 141a. *A. FORSTERI*. YELLOW-EYED MULLET. *Mugil forsteri* Cuvier & Valenciennes, H. N. Poiss. xi, 1836, p. 141. *Dajaus diemensis* Richardson, Ichth. Erebus & Terror, 1845, p. 37, pl. 26, 1-4 (Pl. xiv).

A southern species, plentiful only towards the Victorian border.

142. *TRACHYSTOMA* Ogilby, Proc. Zool. Soc. 1887, p. 614 (*multidens*).

- 142a. *T. PETARDI*. FRESH-WATER MULLET. *Mugil petardi* Castelnau, Res. Fish. Austr., 1875, p. 32. *M. breviceps* Steindachner (*nec.* Cuv. & Val.), Sitzb. Akad. Wiss. Wien liii, 1866, p. 459, pl. 1, 1 (Pl. xiv).

Common in the eastern rivers of the State north of Sydney. Length nearly 2 feet.

LXXIV.

Family ATHERINIDAE.

A. Head and entire body scaly.

B. Premaxillaries not expanded near the symphysis.

C. Gill-rakers slender and numerous; vomer with teeth.

D. Upper edge of each mandibular ramus expanded and elevated posteriorly *Atherina* (143).

DD. Mandibular rami not expanded posteriorly. *Hepsetia* (144).

CC. Gill-rakers rudimentary; palate toothless. *Craterocephalus* (145).

BB. Premaxillaries expanded forward at the symphysis.

E. Anal little longer than the second dorsal. *Pseudomugil* (147).

EE. Anal much longer than the second dorsal.

Melanotaenia (148).

AA. Head and anterior portion of body naked.

Iso (146).

143. *ATHERINA* Linn., Syst. Nat. 10th Ed., 1758, p. 315 (*hepsetus*).
 A. Anal with ten rays. *microstoma* (143a).
 AA. Anal with eighteen rays. *jacksoniana* (143b).
- 143a. A. *MICROSTOMA*. SILVERSIDE. *Id.* Gthr., Brit. Mus. Cat. Fish. iii, 1861, p. 401. *Taeniomembras microstoma* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 32, pl. 10, 2 (Pl. xv).
 Specimens are in the Australian Museum from Eden, New South Wales. Length about 3 inches.
- 143b. A. *JACKSONIANA*. *Id.* Quoy & Gaimard, Voy. Uranie, 1825, p. 333.
 The generic position of this species is uncertain. It has not been recognised since it was first described in 1825.
144. *HEPSETIA* Bonaparte, Fauna Italica, fasc. 91 (*boyeri*).
 144a. H. *PINGUIS*. HARDYHEAD. *Atherina pinguis* Lacep., H.N. Poiss. v, 1803, p. 372, pl. 11, 1; *Id.* Ogilby, Mem. Qld. Mus. i, 1912, p. 38, pl. 12, 1 (Pl. xv).
 Abundant, congregating in shoals. Length 6 inches.
145. *CRATEROCEPHALUS* McCulloch, P. Roy. Soc. Qld. xxiv, 1912, p. 48 (*fluviatilis*).
 145a. C. *FLUVIATILIS*. FRESHWATER SILVERSIDE. *Id.* McCulloch, *Tom. cit.*, p. 49, pl. 1, 1 (Pl. xv).
 Abundant in the streams of the Murray River system. Length about 3 inches.
146. Iso Jordan & Starks, Proc. U.S. Nat. Mus. xxiv, 1901, p. 205 (*flosmaris*).
 146a. I. *RHOTHOPHILUS*. SURF FISH. *Tropidostethus rhotophilus* Ogilby, P.L.S.N.S.W. (2) x, 1895, p. 323; *Id.* Waite, Rec. Austr. Mus. v, 1904, p. 234, pl. 25, 2 (Pl. xv).
 An aberrant atherine which lives in the surf near Sydney, and is sometimes very abundant. Length about 2 inches.
147. *PSEUDOMUGIL* Kner, Novara Zool. i, 1867, p. 275 (*signifer*).
 147a. P. *SIGNIFER*. BLUE-EYE. *Id.* Kner, *Tom. cit.*, pl. 13, 5 (Pl. xv).
 A minute fish, abundant in the coastal streams and waterholes and entering salt water. The male is very ornate with produced fin-rays. Length 2 inches.
148. *MELANOTAENIA* Gill, P. Ac. Nat. Sci. Philad. 1862, p. 280 (*nigrans*).
 148a. M. *NIGRANS*. FRESH-WATER SUN-FISH. *Atherina nigrans* Richardson, A.M.N.H. xi, 1843, p. 180. *Strabo nigrofasciatus* Kner & Steindachner, Sitzb. Akad. Wiss. Wien liv, 1866, pp. 373, 395, pl. 3, 10 (Pl. xv).
 An ornate and very variable fish which has been described under many generic and specific names. It is plentiful in the fresh waters of both eastern and western streams. Length about 4 inches.

LXXV.

Family SPHYRAENIDAE.

149. *SPHYRAENA* Bloch & Schneider, Syst. Ichth., 1801, p. 109 (*SPHYRAENA*).
 A. Ventrals inserted below the adpressed pectorals. *obtusata* (149a).
 AA. Ventrals inserted behind the ends of the pectorals.
 B. First dorsal spine behind that of the ventral. *novae-hollandiae* (149b).
 BB. First dorsal spine before that of the ventral. *waitii* (149c).

- 149a. *S. obtusata*. STRIPED SEA PIKE. *Id.* Cuvier & Valenciennes. Hist. Nat. Poiss. iii, 1829, p. 350; *Id.* Gthr., Fisch. Sudsee vi, 1877, p. 212, pl. 119, b (Pl. xiv.)

Not uncommon on the coast. Length about 16 inches. *S. grandisquamis* Steindachner, Sitzb. Akad. Wiss. Wien liii, 1866, p. 446, from Port Jackson, is apparently synonymous with *S. obtusata*.

- 149b. *S. novae-hollandiae*. SHORT-FINNED SEA PIKE. *Id.* Gthr., Brit. Mus. Cat. Fish. ii, 1860, p. 335; *Id.* Ogilby, Ed. Fish. N.S. Wales, 1893, pl. 30 (Pl. xiv).

A southern species, but generally represented in the Sydney markets in small numbers. Length to 3 feet.

- 149c. *S. waithi*. *Id.* Ogilby, Ann. Qld. Mus. No. 9, 1908, p. 29.

This species is perhaps merely the young of the preceding.

Threadfins. Suborder POLYNEMOIDEA.

Pectoral fins divided into two portions, the lower of which is composed of separate slender thread-like rays.

LXXXVI. Family POLYNEMIDAE.

150. *POLYNEMUS* Linn., Syst. Nat. 10th ed., 1758, p. 317 (*paradiseus*).

A. 13-14 dorsal rays; free pectoral rays not reaching to the anal.

- B. 67 scales to hypural joint; depth of body much less than length of head; preopercular margin coarsely denticulate. *indicus* (150a).

- BB. 60 scales to hypural joint; depth of body equal to length of head; preopercular margin finely serrate. *plebeius* (150b).

AA. 12 dorsal rays; some free pectoral rays reaching the anal. *macrochir* (150c).

- 150a. *P. indicus*. THREADFIN. *Id.* Shaw, Gen. Zool. v, 1804, p. 155; *Id.* McClelland, Calc. Journ. Nat. Hist. iii, 1843, p. 179, pl. 6.

Recorded from Sydney by Gunther, but proof of the occurrence of this species in our waters is required. Length 4 feet.

- 150b. *P. plebeius*. *Id.* Broussonet, Ichth. Deser. et Icones, 1782, 8th plate. *Id.* Gthr., Fisch. Sudsee i, 1873-5, p. 103, pl. lxxvii, a.

A tropical species. One specimen in the Australian Museum from Port Stephens, collected by Fisheries Inspector Paton, May 1913. Length 14 inches.

- 150c. *P. macrochir*. TASSEL FISH. *Id.* Gthr., A.M.N.H. (3) xx, 1867, p. 60.

An imperfectly described and little known species.

Suborder LABYRINTHICI or ANABANTOIDEA.

Families OPHIOCEPHALIDAE and ANABANTIDAE.

Ophiocephalus striatus Bloch, and *Polyacanthus cupanus* Cuv. & Val., have been incorrectly recorded from Sydney by Kner, Novara Zool. i, 1865, pp. 218 & 234. No members of the Suborder are known from Australia.

Suborder STROMATEOIDEA.

Oesophagus with lateral sacs which bear teeth.

- A. Spinous dorsal shorter than soft portion; scales normal, not rugose; mandibular teeth not forming a cutting edge. Family *Stromateidae* (No. lxxvii).

- AA. Spinous dorsal longer than soft portion; scales rugose; mandibular teeth compressed to form a cutting edge. Family *Tetragonuridae* (No. lxxviii).

LXXVII.

Family STROMATEIDAE.

- A. Spinous dorsal distinct from the soft portion though the two may be in contact.
 B. Spinous dorsal at least as high as the soft.
 C. Vomer and palatines with teeth. *Nomeus* (151).
 CC. Palate toothless. *Psenes* (152).
 BB. Dorsal spines shorter than the rays.
 D. Operculum covered with thick skin or naked. *Seriotelella* (153).
 DD. Operculum covered with small scales. *Hyperoglyphe* (154).
 AA. Spinous dorsal completely united with the soft portion, the two forming a single fin.
 E. Body elongate. *Centrolophus* (155).
 EE. Body ovate. *Schedophilus* (156).

151. NOMEUS Cuvier, Regne Anim. ii, 1817, p. 315 (*gronovii*).

151a. N. GRONOVII. PORTUGUESE MAN-O-WAR FISH. *Gobius gronovii* Gmelin. Syst. Nat. 13th ed., 1789, p. 1025. *N. gronovii* Goode & Bean, Oceanic Ichth., 1895 p. 220, pl. 63, 227 (Pl. xv).

This species secures protection from its enemies among the tentacles of the Physalia or Portuguese Man-o-war, to the stings of which it is perhaps immune. It is distributed throughout all temperate and tropical seas. Length 6 inches.

152. PSENES Cuvier & Valenciennes, Hist. Nat. Poiss. ix, 1833, p. 259 (*cyanophrys*).

- A. D. x, i, 27-27; A. iii, 25-27. *cyanophrys* (152a).
 AA. D. xi, i, 19; A. iii, 19. *whiteleggii* (152b).

152a. P. CYANOPHRYS. *Id.* Cuvier & Valenciennes, Hist. Nat. Poiss. ix, 1833, p. 260, pl. 265.

A rare species in our waters.

152b. P. WHITELEGGII. *Id.* Waite, P.L.S.N.S.W. (2) ix, 1894, p. 218, pl. 17, 1 (Pl. xvi).

A pelagic species, occasionally washed up on coastal beaches. Length about 2 inches.

153. SERIOLELLA Guichenot, in Gay, Hist. Chile, Zool. ii, 1848, p. 238 (*porosa*).

- A. Pectoral reaching to vertical of anal origin; depth about 2.6 in length. *brama* (153a).
 AA. Pectoral not nearly reaching vertical of anal origin; depth 3.3-4 in length. *punctata* (153b).

153a. S. BRAMA. SNOTGALL TREVALLA. *Neptomenus brama* Gthr., Brit. Mus. Cat. Fish. ii, 1860, p. 390. *S. brama* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 34, pl. 9, 1 (Pl. xvi).

A common southern species, but rare in New South Wales waters. Length 30 inches.

153b. S. PUNCTATA. MACKEREL TREVALLA. *Gasterosteus punctatus* (Forster) Bloch & Schneider, Syst. Ichth. 1801, p. 36. *S. punctata* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 316, pl. 10, 1 (Pl. xvi).

Rare in New South Wales, but common southwards. Length 12 inches.

154. HYPEROGLYPHE Gthr., Brit. Mus. Cat. Fish. i, 1859, p. 337 (*porosa*).

154a. H. POROSA. *Diagramma porosa* Richardson, Ichth. Erebus & Terror, 1845, p. 26, pl. 16, 5-6 (Pl. xvi).

The only record of this species in New South Wales waters is unreliable.

155. *CENTROLOPHUS* Lacépède, Hist. Nat. Poiss. iv, 1802, p. 441 (*niger*).
 155a. *C. MAURICUS*. *Id.* Ogilby, Rec. Austr. Mus. ii. 5, 1893, p. 64; *Id.*
 McCulloch, Rec. Austr. Mus. xii. 8, 1919, p. 176, pl. 26, 2 (Pl. xvi).
 A rare oceanic species recently recorded from our waters. Length 30 inches.

156. *SCHEDOPHILUS* Cocco, Innom. Messina Ann. iii, 1820, p. 57 (*medusophagus*).

- 156a. *S. MACULATUS*. RAFT FISH. *Id.* Guthr., Brit. Mus. Cat. Fish. ii, 1860, p. 412; *Id.* Waite, Rec. Austr. Mus. v, 1904, p. 163, pl. 20, 1 (Pl. xvi).

A pelagic species which is sometimes cast up on ocean beaches. Length 4 inches.

LXXXVIII.

Family TETRAGONURIDAE.

157. *TETRAGONURUS* Risso, Ichth. Nice, 1810, p. 347 (*cuvieri*).

- 157a. *T. CUVIERI*. SQUARE-TAIL. *Id.* Risso, *Op. cit.* *Id.* Valenciennes, Illustr. Poiss. Règne Anim., 1837, p. 166, pl. 76, 2 (Pl. xv).

A widely distributed oceanic species, only once recorded from the New South Wales coast.

PERCH-LIKE FISHES—Suborder PERCOIDEA.

Not more than six rays in the ventral fins. Second suborbital bone not forming a stay for the preoperculum.

Key to the subdivisions, based upon Regan's classification of the Suborder (A.M.N.H. (8) xii, 1913, p. 111).

A. Ventrals with 1 spine and 4-5 rays.

B. Lower pharyngeals not ankylosed.

C. Two nostrils on each side.

D. 23 or more vertebrae; 1-2 pectoral radials inserted on the hypocoracoid; gill-openings wide.

E. Anal fin preceded by 2-3 pungent spines.

F. Lower pectoral rays branched, not specially thickened.

Perciformes.

FF. Lower pectoral rays simple and thickened. *Cirrhitiformes.*

EE. Anal spines if present weak and not more than two in number.

G. 3 pectoral radials on the hypocoracoid; base of pectoral fin oblique. *Champsodontiformes.*

GG. 2 pectoral radials on the hypocoracoid; base of pectoral fin vertical. *Trachiniformes.*

DD. 21 vertebrae; 3 pectoral radials inserted on the hypocoracoid; gill-openings reduced to small openings above the end of the operculum in Australian species. *Callionymiformes.*

CC. A single nostril on each side. *Nototheniiformes.*

BB. Lower pharyngeals ankylosed to form a single bone.

H. A single nostril on each side. *Pomacentriformes.*

HH. 2 nostrils on each side. *Labriformes.*

AA. Ventrals with 1 spine and 1 ray. *Gadopsiformes.*

LXXIX.

Family Serranidae.

A. Teeth present on the vomer, and usually on the palatines also.

B. Jaws with fixed canines; marine.

C. Lateral line extending along the caudal peduncle near its upper surface.

Callanthias (158).

- CC. Lateral line extending along the middle of each side of the caudal peduncle.
- D. A large patch of teeth on the tongue. *Caprodon* (159).
- DD. Tongue toothless.
- E. Maxilla and mandible covered with rather large scales.
- F. Dorsal with 19-23 rays; anal with 9-10. *Caesioperca* (160).
- FF. Dorsal with 14-18 rays; anal with 6-8. *Anthias* (161).
- EE. Maxilla and mandible either naked or with imperfect scales.
- G. Scales small, many more than 4 between lateral line and middle of back.
- H. Some inner teeth of jaws hinged and depressible; 9-12 dorsal spines. *Epinephelus* (162).
- HH. Inner jaw teeth not depressible; 13 dorsal spines. *Acanthistius* (163).
- GG. Scales larger, about 4 between lateral line and middle of back.
- I. Scales of lateral line scarcely different from the others *Gilbertia* (164).
- II. Scales of lateral line differentiated with ridges and crenulate edges. *Hypoplectrodes* (165).
- BB. No canines, teeth villiform or the outer ones slightly enlarged; fluvialile or estuarine.
- J. A well developed patch of teeth on each palatine.
- K. Mucous cavities of head inconspicuous.
- L. Ventrals inserted before pectorals, scales small. *Oligorus* (166).
- LL. Ventrals inserted behind pectorals, scales large. *Percalates* (167).
- KK. Mucous cavities of head conspicuous. *Plectroptites* (168).
- JJ. Palatines toothless or with a few teeth. *Macquaria* (169).
- AA. Vomer toothless or with a very few teeth; palatines toothless.
- M. Gill-membranes united across the isthmus.
- N. Teeth not trilobate. *Therapon* (170).
- NN. Teeth trilobate. *Helotes* (171).
- MM. Gill-membranes separated by and attached to the isthmus. *Pelates* (172).
158. CALLANTHIAS Lowe, P. Zool. Soc. Lond., 1839, p. 76 (*paradiseus*).
- 158a. C. ALLPORTI. ALLPORTS PERCH. *Id.* Gthr., A.M.N.H. (4) xvii, 1876, p. 390; *Id.* Boulenger, Brit. Mus. Cat. Fish. i, 1895, p. 335, pl. 15 (Pl. xvii).
- A brilliantly coloured fish which is commonly taken by the trawlers in deep water. Length 12 inches.
159. CAPRODON Temm. & Schlegel, Faun. Japonica, Pisces, 1844, p. 64 (*schlegeli*).
- 159a. C. LONGIMANUS. LONG-FINNED PERCH. *Anthias longimanus* Gthr., Brit. Mus. Cat. Fish. i, 1859, p. 94. *C. longimanus* Boulenger, Brit. Mus. Cat. Fish. i, 1895, p. 315, pl. 12 (Pl. xvii).
- A rare species occasionally captured in deep water. Length 16 inches.
160. CAESIOPERCA Castelnau, P. Zool. Soc. Viet. i, 1872, p. 49 (*rasor*).
- 160a. C. LEPIDOPTERA. RED PERCH. *Epinephelus lepidopterus* (Forster) Bloch & Schneider, Syst. Ichth., 1801, p. 302. *C. lepidoptera* Waite, Prelim. Rept. Thetis Exped., 1898, p. 31, pl. 1 (Pl. xvii).
- Abundant in moderate depths where it is taken by the trawlers. Length 12 inches.

161. ANTHIAS Bloch, Ausl. Fische vi, 1792, p. 97 (*sacer*).

161a. A. PULCHELLUS. ORANGE PERCH. *Id.* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 77, pl. 12 (Pl. xvii).

Not uncommonly taken by the trawlers. Length 11 inches.

162. EPINEPHELUS Bloch, Ausl. Fische vii, 1793, p. 14 (*marginalis*).

A. Anal fin with 8 rays; crossbands, if present, oblique.

B. Caudal fin rounded.

C. Lower opercular spine below or behind the vertical of the upper one.

D. Body without large dark spots.

E. Body with six more or less distinct oblique cross-bars.

damelii 162a).

EE. Body with narrow longitudinal undulating lines.

undulatostratus (162b).

D. Body with large dark spots.

F. Dark spots broader than the spaces between them.

merra (162c).

FF. Dark spots smaller than the spaces between them.

tauvina (162d).

CC. Lower opercular spine before the vertical of the upper one.

G. L. lat. 110-145, tubules not branched.

fuscoguttatus (162e).

GG. L. lat. 100-110, tubules branched.

lanceolatus (162f).

BB. Caudal fin truncate.

flavocacruleus (162g).

AA. Anal fin with 9 rays; body with 7 vertical dark cross-bars.

septemfasciatus (162h).

162a. E. DAMELLI. BLACK ROCK COD. *Serranus damelii* Gthr., A.M.N.H.

(4), xvii, 1873, p. 391. *E. daemelii* Boulenger, Brit. Mus. Cat. Fish. i, 1895, p. 223, pl. 7 (Pl. xvii).

Inhabits rocky reefs and preys upon smaller fishes and crustaceans. A valuable food-fish, growing to over four feet in length.

162b. E. UNDULATOSTRIATUS. RED-SPECKLED ROCK COD. *Serranus undulatostratus* Peters, Monatsb. Akad. Berlin, 1866, p. 518. *Serranus gutturalatus* Macleay, P.L.S.N.S.W. iii, 1878, p. 33, pl. 2.

Not very common. Length about 14 inches.

162c. E. MERRA. *Id.* Bloch, Ausl. Fische vii, 1793, p. 17, pl. 329. *Serranus hexagonatus* Gthr., Fische Sudsee i, 1873, p. 7, pl. 7.

A common tropical species, unreliably recorded from Port Jackson by Castelnau.

162d. E. TAUVINA. BROWN-SPOTTED ROCK COD. *Perca tauvina* Forskal, Deser. Anim., 1775, p. 39. *E. tauvina*, Stead, Ed. Fish. N.S. Wales, 1908, p. 58, pl. 27.

A tropical species, occurring in the northern waters of the State. Length 4 feet.

162e. E. FUSCOGUTTATUS. *Perca summana* var. *fuscoguttata* Forskal, Deser. Anim., 1775, p. 42. *E. fuscoguttatus* Bleeker, Atlas Ichth. vii, 1876, p. 57, pl. 307, 3.

A tropical species, said to have been taken in Port Jackson.

162f. E. LANCEOLATUS. QUEENSLAND GROPER. *Holocentrus lanceolatus* Bloch, Ausl. Fische. iv, 1790, p. 92, pl. 242, 1. *E. lanceolatus* Bleeker, Atlas. Ichth. vii, 1876, p. 49, pl. 332, 3 (Pl. xvii).

A giant species, reaching 6 feet in length, which is captured in the estuaries of our northern rivers. It has been incorrectly identified as *Promicrops itiana* in other lists. The young are brilliantly ornamented with black and yellow, but the adults are uniformly dark in colour.

- 162g. E. FLAVOCAERULAEUS Lacepede, var. *hoedtii* Bleeker. *Serranus hoedtii* Bleeker, Nat. Tijd. Ned. Ind. viii, 1855, p. 406, and Atlas Ichth. vii, 1876, p. 45, pl. 283, 2 (Pl. xvii).

A specimen received from the Fisheries Department was taken in the Clarence River estuary.

- 162h. E. SEPTEMFASCIATUS. GREY-BANDED ROCK COD. *Perca 7-fasciata* Thunberg, Vetensk. Acad. Handl. Stockholm xiv, 1793, p. 56, pl. 1. *Plectropoma susuki* Schlegel, Faun. Japonica, Pisces, 1842, p. 11, pl. 4, 1.

A rather rare species occurring in deeper water. Length about 12 inches.

163. ACANTHISTIUS Gill, P. Acad. N. Sci. Philad., 1862, p. 236 (*serratus*).

- 163a. A. SERRATUS. Wirrah. *Plectropoma serratum* Cuv. & Val., H.N. Poiss. ii, 1828, p. 399; *Id.* Quoy & Gaimard, Voy. Astrolabe, Zool. iii, 1835, p. 662, pl. 2, 1 (Pl. xvii).

Similar to the Rock Cods in appearance but of inferior edible quality. Lives among rocks, and grows to 20 inches long.

164. GILBERTIA Jordan & Eigenmann, Bull. U.S. Fish. Comm. viii, 1890, p. 346 (*semicinctum*).

- A. Cross-bands descending to lower half of body. *annulata* (164a).
AA. Cross-bands confined to upper half of body.
B. Reddish, with 6-7 oblique cross-bars on upper half. *semicincta* (164b).
BB. Brownish, variegated with darker markings on the sides. *jamesoni* (164c).

- 164a. G. ANNULATA. BANDED SEA PERCH. *Plectropoma annulatum* Gunther, Brit. Mus. Cat. Fish. i, 1859, p. 158, and Cruise Curacoa, 1873, p. 415, pl. 28, b (Pl. xviii).

A rather uncommon species reaching a length of 10 inches.

- 164b. G. SEMICINCTA. HALF-BANDED SEA PERCH. *Plectropoma semicinctum* Cuvier & Valenciennes, Hist. Nat. Poiss. ix, 1833, p. 442. *Plectropoma huntii* Hector, Tr. N. Zeal. Inst. vii, 1875, p. 240, pl. 10, 1.

A small fish, not uncommon among rocks along the coast. Length 8 inches.

- 164c. G. JAMESONI. *Hypoplectrodes jamesoni* Ogilby, Proc. Roy. Soc. Qld. xxi, 1908, p. 16. *H. jamesoni* McCulloch, Rec. Austr. Mus. ix, 1913, p. 359, pl. 13, 1 (Pl. xviii).

Rare in New South Wales. Length 4 inches.

165. HYPOPLECTRODES Gill, P. Acad. Nat. Sci. Philad., 1862, p. 236 (*nigrorubrum*).

- 165a. H. NIGRORUBRUM. *Plectropoma nigrorubrum* Cuv. & Val., H.N. Poiss. ii, 1828, p. 402; *Id.* Quoy & Gaimard, Voy. Astrolabe, Zool. iii, 1835, p. 659, pl. 4, 1 (Pl. xviii).

A rather uncommon species inhabiting rocky localities. Length 10 inches.

166. OLIGORUS Gunther, Brit. Mus. Cat. Fish. i, 1859, p. 251 (*macquariensis*).

- 166a. *O. MACQUARIENSIS*. MURRAY COD. *Grystes macquariensis* Cuv. & Val., H.N. Poiss. iii, 1829, p. 58. *O. macquariensis* McCoy, Prodr. Zool. Viet. Dec. ix, 1884, pl. 85-86 (Pl. xviii).

A most valuable foodfish, inhabiting the Murray River system and the head waters of some northern streams. It varies considerably in form and colour-marking, and one variety with trout-like markings and an overhanging upper jaw has been regarded as a distinct species under the name of Trout Cod, *Oligorus mitchelli* Castelnau. Length to 5 feet.

167. PERCALATES Ramsay & Ogilby, P.L.S.N.S.W. (2) ii, 1887, p. 182 (*colonorum*).

- 167a. *P. COLONORUM*. AUSTRALIAN PERCH. *Lates colonorum* Gthr., A.M.N.H. (3) xi, 1863, p. 114. *Dules novemaculeatus* Steindachner, Sitzb. Akad. Wiss. Wien liii. i, 1866, p. 5, pl. 2, 1 (Pl. xviii).

Another important food-fish, inhabiting the coastal rivers and descending to the salt-water estuaries. Its variations in form and colour have led to the supposition that there is more than one species, but deeper bodied estuarine specimens are linked up with the more slender fresh-water examples by a chain of intermediate forms. Length 20 inches.

168. PLECTROPLITES Gill, P. Ac. Nat. Sci. Philad., 1862, p. 236 (*ambiguus*).

- 168a. *P. AMBIGUUS*. GOLDEN PERCH. *Datnia ambigua* Richardson, Ichth. Erebus & Terror, 1845, p. 25, pl. 19. *Ctenolates ambiguus* McCoy, Prodr. Zool. Viet. Dec. ix, 1884, pl. 84 (Pl. xviii).

Another very valuable food-fish, occurring abundantly in the western river system. Length 2 feet.

169. MACQUARIA Cuv. & Val., H.N. Poiss. v, 1830, p. 377 (*australasica*).

- 169a. *M. AUSTRALASICA*. MACQUARIE PERCH. *Id.* Cuv. and Val., *Tom. cit.*, pl. 131; *Id.* Lesson, Voy. Coquille, Zool. ii, 1826, p. 194, pl. 14, 1 (Pl. xviii).

Abundant in some western waters, and occurring in a few coastal streams also. Length 15 inches.

170. THERAPON Cuvier (*Terapon* in error), Reg. Anim. ii, 1817, p. 295 (*servus*).

A. Lower opercular spine produced beyond opercular lobe; a dark blotch on the spinous dorsal. *servus* (170a).

AA. Lower opercular spine not produced beyond opercular lobe; no dark blotch on the spinous dorsal.

B. Suprascapular bone not exposed, hidden by scales. *unicolor* (170b).

BB. Suprascapular bone exposed, not hidden by scales. *bidyana* (170c).

- 170a. *T. SERVUS*. *Holocentrus servus* Bloch, Ausl. Fische iv, 1790, p. 80, pl. 238, 1; *T. jarbua* Day, Fish. India, 1875, p. 69, pl. 18, 4 (Pl. xix).

A tropical marine species occasionally wandering into New South Wales waters. Length 8 inches.

- 170b. *T. UNICOLOR*. SPANGLED GRUNTER. *Id.* Gunther, Brit. Mus. Cat. Fish. i, 1859, p. 277; *Id.* Ogil. & McCull., Mem. Qld. Mus. v, 1916, p. 109, pl. 11, 1 (Pl. xix).

A small species occurring in the western rivers of New South Wales.

- 170c. T. BIDYANA. SILVER PERCH. *Acerina, Cernua, bidyana* Mitchell, Three Exped. Int. E. Austr. i, 1838, p. 95, pl. 8. *Therapon ellipticus* Stead, Ed. Fish. N.S. Wales, 1908, p. 73, pl. 42 (Pl. xix).

Inhabits the western streams of the State, and while affording good sport for anglers, is a valuable food-fish. Length 16 inches.

171. HELOTES Cuv. & Val., H.N. Poiss. iii, 1829, p. 149 (*sexlineatus*).

- 171a. H. SEXLINEATUS. *Therapon sexlineatus* Quoy & Gaimard, Voy. Uranie, Zool., 1825, p. 340, pl. 59, 1. *H. sexlineatus* Bleeker, Atlas Ichth. vii, 1876, p. 118, pl. 64, 5 (Pl. xix).

This species was included in a list of Port Jackson fishes by Castelnau, but though widely distributed around the Australian coast, there is no evidence to prove its occurrence in New South Wales waters.

172. PELATES Cuv. & Val., H.N. Poiss. iii, p. 145 (*quadrilineatus*).

- 172a. P. SEXLINEATUS. TRUMPETER. *Therapon sexlineatus* Quoy & Gaimard, Voy. Uranie, Zool., 1824, p. 320. *P. quadrilineatus* Cuv. & Val., (nec. Bloch), H.N. Poiss. iii, 1829, p. 146, pl. 55 (Pl. xix).

Common on the sand flats in shallow water. Length 8 inches.

LXXX.

Family PLESIOPIDAE.

- A. Maxilla with a supplemental bone; a patch of teeth on the tongue.

Paraplesiops (173).

- AA. No supplemental maxillary bone and no teeth on the tongue.

Trachinops (174).

173. PARAPLESIOPS Bleeker, Verh. Akad. Amst. xv, no. 5, 1875, p. 3 (*bleekeri*).

- 173a. P. BLEEKERI. ROUNDHEAD. *Plesiops bleekeri* Gthr., Brit. Mus. Cat. Fish. iii, 1861, p. 364. *Paraplesiops bleekeri* Ogilby, Mem. Qld. Mus. vi, 1918, p. 46, pl. 16 (Pl. xix).

Not uncommon around rocky reefs. Length 12 inches.

174. TRACHINOPS Gunther, Brit. Mus. Cat. Fish. iii, 1861, p. 366 (*taeniatus*).

- 174a. T. TAENIATUS. *Id.* Gthr., *Tom. cit.*; *Id.* Kner, Zool. Novara i, Fische, 1865, p. 215, pl. 8, 7 (Pl. xix).

A rare species. Length 3½ inches.

LXXXI.

Family KUHLIIDAE.

- A. Caudal forked, lateral line complete; marine.

Kuhla (175).

- AA. Caudal rounded, lateral line interrupted; fluviatile.

Nannoperca (176).

175. KUHLIA Gill, P. Acad. N. Sci. Philad., 1861, p. 48 (*ciliata*).

- 175a. K. TAENIURA. FLAGTAIL. *Dules taeniurus* Cuv & Val., H.N. Poiss. iii, 1829, p. 114. *Moronopsis taeniurus* Bleeker, Atlas Ichth. viii, 1877, p. 119, pl. 345, 5 (Pl. xix).

A tropical species, occasionally wandering southward to Port Jackson.

176. NANNOPERCA Gunther, Proc. Zool. Soc., 1861, p. 116 (*australis*).

- 176a. N. AUSTRALIS. PIGMY PERCH. *Id.* Gthr., *Tom. cit.*, pl. 19, 2; *Id.* McCulloch & Waite, Rec. S. Austr. Mus. i.1, 1918, p. 46, pl. 2, 1 (Pl. xx).

A minute species, the affinities of which are uncertain. It occurs plentifully in the Murray River. Length 3 inches.

LXXXII. Family PRIACANTHIDAE.

177. PRIACANTHUS Cuvier (Oken), Reg. Anim. ii, 1817, p. 281 (*macrophthalmus*).

A. Body much more than twice as long as deep; ventral fins as long as head.

Macracanthus (177a).

AA. Body almost half as deep as long; ventrals much longer than the head.

velabundus (177b).

177a. P. MACRACANTHUS. RED BULLSEYE. *Id.* Cuv. & Val. H.N. Poiss.

iii, 1829, p. 108. P. *bennebari* Schlegel, Faun. Japonica, Pisces,

1842, p. 19, pl. 7, 1.

Not uncommon in deep water. Length 12 inches.

177b. P. VELABUNDUS. *Id.* McCulloch, Biol. Res. Endeavour iii. 3, 1915, p.

114, pl. 19 (Pl. xx).

A rare deep water species. Length 8 inches.

LXXXIII. Family APOGONIDAE.

A. Second dorsal fin as long as the anal.

B. Two anal spines.

C. Preoperculum serrated; marine.

Apogon (178).

CC. Preoperculum entire.

D. Scales cycloid, tongue toothless; marine.

Adenapogon (179).

DD. Scales ciliated, tongue with teeth; fluviatile.

Glossamia (180).

BB. Three anal spines.

Apogonops (181).

AA. Anal much longer than second dorsal.

Dinolestes (182).

178. APOGON Lacépède, H.N. Poiss. iii, 1802, p. 411 (*ruber*).

A. Body with dark longitudinal stripes.

B. More than two stripes on each side.

fasciata (178a).

BB. Two stripes on each side.

quadrifasciata (178b).

AA. Body without longitudinal stripes.

C. A lark ocellus above the pectoral.

atripes (178c).

CC. No definite colour-markings.

novae-hollandiae (178d).

178a. A. FASCIATUS. SOLDIER FISH. *Mullus fasciatus* Shaw, White's Voy.

N.S. Wales, 1790, p. 268 and plate. *Amia fasciata* var. *stevensi*

McCulloch, Biol. Res. Endeavour iii. 3, 1915, pl. 16, 2 (Pl. xx).

Commonly taken in seine nets in shallow harbours and estuaries. Length 5 inches.

178b. A. QUADRIFASCIATUS. *Id.* Cuv. & Val., H.N. Poiss. ii, 1828, p. 153.

Amia quadrifasciata Bleeker, Atlas Ichth. vii, 1876, p. 88, pl. 335, 1.

A tropical species, rare in New South Wales waters. Length 4½ inches.

178c. A. ATRIPES. *Amia nigripes* Ogilby (*nec.* Playfair), Ann. Qld. Mus.

No. 10, 1911, p. 49, pl. 5, 2; *Id.* McCulloch, Biol. Res. Endeavour, iii,

3, 1915, p. 119, pl. 15, 2. A. *atripes*; Ogilby, P. Roy. Soc. Qld. xxviii,

1916, p. 116 (Pl. xx).

Occurs in the northern river estuaries. Length 4 inches.

178d. A. NOVAE-HOLLANDIAE. *Id.* Valenciennes, Nouv. Ann. Mus. Hist.

Nat., 1832, p. 55, pl. 4, 2. ? A. *guntheri* Castelnau, P. Zool. Soc.

Vict. i, 1872, p. 46.

A very imperfectly known species, of which the above synonymy may not be correct.

179. ADENAPOGON McCulloch, Rec. Austr. Mus. xiii. 4, 1921, p. 132.
(*roseigaster*).
- A. Dorsal and anal fins each with 10 rays, their margins straight.
roseigaster (179a).
- AA. Dorsal and anal fins each with 8 rays, their margins rounded. *woodi* (179b).
- 179a. A. ROSEIGASTER. *Apogon roseigaster* Ramsay & Ogilby, P.L.S.N.S.W.
(2) i, 1887, p. 1101. *Adenapogon roseigaster* McCulloch, Rec. Austr.
Mus. xiii. 4, 1921, p. 133, pl. 21, 2 (Plate xx).
A minute species, 3 inches long.
- 179b. A. WOODI. *Id.* McCulloch, Rec. Austr. Mus. xiii. 4, 1921, p. 134,
pl. 21, 3.
180. GLOSSAMIA Gill, P. Acad. N. Sci. Philad., 1863, p. 82 (*aprior*).
- 180a. G. GILLII. *Apogonichthys gillii* Steindachner, Sitzb. Akad. Wiss.
Wien lvi. i, 1867, p. 11, pl. 1, 1. *G. gillii* McCulloch, Rec. Austr.
Mus. xi. 7, 1917, p. 171, pl. 21, 4 (Pl. xx).
A fresh water species. Length about 5 inches.
181. APOGONOPS Ogilby, P.L.S.N.S.W. xxi, 1896, p. 23 (*anomalus*).
- 181a. A. ANOMALUS. *Id.* Ogilby, *Tom. cit.*, p. 24; *Id.* McCulloch, Zool.
Res. Endeavour i. 1, 1911, p. 55, fig. 13 (Pl. xx).
Abundant in depths about 60 fathoms, where it is largely preyed upon by the
Deep-sea Flathead, *Platycephalus macrodon*. Length 5 inches.
182. DINOlestes Klunzinger, Arch. Naturg. xxxviii. i, 1872, p. 29 (*mulleri*).
- 182a. D. LEWINI. LONG-FINNED SEA PIKE. *Esox lewini* Griffiths, Cuv.
Anim. Kingd. x, 1834, p. 465, pl. 60. *Lanioperca mordax* McCoy,
Prodr. Zool. Viet. dec.xii, 1886, p. 115 (Pl. xx).
A southern species. Length 20 inches.

LXXXIV.

Family SILLAGINIDAE.

- A. Dorsal fins united, scales small, about 130. *Sillaginodes* (183).
- AA. Dorsal fins separate; scales larger, 65-75. *Sillago* (184).
183. SILLAGINODES Gill, P. Acad. N. Sci. Philad., 1861, p. 504 (*punctatus*).
- 183a. S. PUNCTATUS. SPOTTED WHITING. *Sillago punctatus* Cuv. & Val.,
H.N. Poiss. iii, 1829, p. 413; *Id.* Quoy & Gaimard, Voy. Astrolabe,
Zool. iii, 1835, p. 671, pl. 1, 1 (Pl. xxi).
A southern species, not usually plentiful in our waters. Length 18 inches.
184. SILLAGO Cuvier, R. Anim. ii, 1817, p. 258 (*acuta*).
- A. A conspicuous dark mark at the base of the pectoral fin.
- B. Caudal peduncle as broad as postorbital portion of head. *ciliata* (184a).
- BB. Caudal peduncle narrower than postorbital portion of head.
maculata (184b).
- AA. No black mark on base of pectoral fin.
- C. Ventrals inserted below origin of first dorsal. *robusta* (184c).
- CC. Ventrals inserted in advance of origin of first dorsal. *bassensis* (184d).
- 184a. S. CILIATA. SAND WHITING. *Id.* Cuv. & Val., H. N. Poiss. iii, 1829,
p. 415; *Id.* McCoy, Prodr. Zool. Viet. dec.xix, 1889, pl. 182.
A fine edible fish, occurring on sandy bottoms all along the coastline. Length
18 inches.

- 184b. *S. MACULATA*. TRUMPETER WHITING. *Id.* Quoy & Gaimard, Voy. Uranie, 1824, p. 261, pl. 53, 2; *Id.* Bleeker, Atlas. Ichth. ix, 1877, pl. 389, 5 (Pl. xxi).

A rather more estuarine species than the preceding, and not quite so plentiful. Length about 12 inches.

- 184c. *S. ROBUSTA*. *Id.* Stead, New Fish. N.S. Wales, 1908, p. 7, pl. 2. Known only from the unique holotype. Length about 6 inches.

- 184d. *S. BASSENSIS*. SCHOOL WHITING. *Id.* Cuv. & Val., H.N. Poiss. iii, 1829, p. 412; *Id.* Quoy & Gaimard, Voy. Astrolabe, Zool. iii, 1835, p. 672, pl. 1, 2 (Pl. xxi).

A small but fine table fish which is plentiful in deeper waters. Length 10 inches.

LXXXV. Family POMATOMIDAE.

185. *POMATOMUS* Lacepede, H.N. Poiss. iv, 1802, p. 435 (*skib*).

- 185a. *P. SALTATRIX*. TAILOR. *Perca saltatrix* Linn., Syst. Nat. 10th ed., 1758, p. 293. *Temnodon saltator* McCoy, Prodr. Zool. Viet. dec. xix, 1889, pl. 183 (Pl. xxi).

A voracious species which is plentiful on the coast, the young occurring abundantly in harbours and estuaries. Length 3 feet.

LXXXVI. Family RACHYCENTRIDAE.

186. *RACHYCENTRON* Kaup, Isis xix, 1826, p. 89 (*typus*).

- 186a. *R. PONDICERIANUM*. BLACK KINGFISH. *Eleate pondiceriana* Cuv. & Val., H.N. Poiss. viii, 1831, p. 329. *E. nigra* Day, Fish. India, 1876, p. 256, pl. 55, 2 (Pl. xxi).

A widely distributed oceanic fish which is sometimes plentiful on this coast. Length 4 feet.

LXXXVII. Family CARANGIDAE.

- A. Caudal peduncle with a series of enlarged bony scutes on the lateral line.
 B. Lateral line armed along its whole length. *Trachurus* (187).
 BB. Lateral line armed on part of its length only.
 C. Dorsal and anal fins each with a detached posterior ray. *Decapterus* (188).
 CC. Posterior dorsal and anal rays not detached.
 D. Body oblong, not greatly compressed. *Caranx* (189).
 DD. Body rhomboid, greatly compressed. *Alectis* (190).
 AA. No bony scutes on the caudal peduncle.
 E. Dorsal and anal without detached finlets.
 F. Caudal peduncle with a keel on each side. *Naucrates* (191).
 FF. Caudal peduncle without keels.
 G. Dorsal spines united by membrane. *Seriola* (192).
 GG. Dorsal spines not united by membrane. *Trachinotus* (193).
 EE. Dorsal and anal with more or less detached finlets.
 H. Dorsal spines connected by membrane. *Elagatis* (194).
 HH. Dorsal spines not connected by membrane. *Scomberoides* (195).

187. TRACHURUS Rafinesque, Caratt. Gen. Spec. Sicilia, 1810, p. 41 (*trachurus*).
- A. Depth 4-4.4 in the length; less than 73 scutes on the lateral line.
- AA. Depth 4.7-5.2 in the length; more than 73 scutes on the lateral line.
- 187a. T. DECLIVIS. YELLOW-TAIL. *Caranx declivis* Jenyns, Zool. Beagle iii, 1841, p. 68, pl. 14 (Pl. xxii.)
- Abundant in all inlets. Length 13 inches.
- 187b. T. NOVAE-ZELANDIAE. COWANYOUNG. *Id.* Richardson, 12th. Rept. Brit. Assn. 1842 (1843), p. 21. *T. trachurus* McCoy, Prodr. Zool. Viet. dec.ii, 1878, pl. 18.
- An oceanic species, sometimes entering inlets in shoals. Length 18 inches.
188. DECAPTERUS Bleeker, Nat. Tijd. Ned. Ind. i, 1851, p. 358 (*kurra*).
- 188a. D. LEPTOSOMUS. *Id.* Ogilby, P.L.S.N.S.W. xxii, 1898, p. 760.
- A little known species. Length about 7 inches.
189. CARANX Lacepede, H.N. Poiss. iii, 1802, p. 57 (*carangus*).
- A. Dorsal and anal fins emarginate, the anterior rays longest.
- B. Median dorsal spines much longer than the eye; lateral line strongly arched.
- BB. Median dorsal spines about as long as the eye; lateral line feebly arched.
- AA. Dorsal and anal fins rounded, the median rays longer than the anterior.
- 189a. C. GEORGIANUS. TREVALLY. *Id.* Cuv. & Val., H.N. Poiss. ix, 1833, p. 85; *Id.* McCulloch, Biol. Res. Endeavour iii. 3, 1915, p. 126, pl. 20 (Pl. xxii).
- Plentiful on the coast, the young entering inlets where they are often captured with hauling nets. Length 30 inches.
- 189b. C. FERDAU. BLUE TREVALLY. *Scomber ferdau* Forskal, Descr. Anim., 1775, p. 55. *Caranx ferdau* Gunther, Fische Sudsee v, 1876, p. 134, pls. 77-78. ? *Caranx hippos* Ogilby, Cat. Fish, N.S. Wales, 1886, p. 26 (Not *C. hippos* Linn.).
- A widely distributed tropical species which is occasionally captured outside Port Jackson. It is probable that references to *C. hippos* in New South Wales are based upon this species.
- 189c. C. HULLIANUS. *Id.* McCulloch, Rec. Austr. Mus. vii, 1909, p. 319, pl. 91 (Pl. xxii).
- Known only from the unique holotype, 4½ inches long.
190. ALECTIS Rafinesque, Analyse Nature, 1815, p. 84 (*virescens*).
- A. Eye half as wide as the preorbital.
- AA. Eye as wide as the preorbital.
- 190a. A. INDICA. DIAMOND TREVALLY. *Scyris indica* Ruppell, Atlas Fische Roth. Meer. 1828, p. 128, pl. 33, 1. *A. indica* Ogilby, Mem. Qld. Mus. iii, 1915, p. 83, pl. 26.
- A widely distributed tropical species which wanders into our northern waters. Length 3 feet.

- 190b. A. CILIARIS. PENNANT FISH. *Zeus ciliaris* Bloch, Ausl. Fische vi, 1788, p. 29, pl. 91. A. *ciliaris* Ogilby, Mem. Qld. Mus. iii, 1915, p. 88, pl. 27 (Pl. xxii).

Another tropical species occasionally extending southward to Port Jackson. Length 14 inches.

191. NAUCRATES Rafinesque, Carat. Gen. Spec. Sicilia, 1810, p. 43 (*fanfarus*).
191a. N. DUCTOR. PILOT FISH. *Gasterosteus ductor* Linn., Syst. Nat. 10th ed., 1758, p. 295. *Naukrates indicus* Valenciennes, Illustr. Poiss. Regne Anim., 1837, p. 125, pl. 54, 1 (Pl. xxii).

192. SERIOLA Cuvier, R. Anim. ii, 1817, p. 315 (*dumerili*).

A. 31-34 dorsal rays.

B. Depth of body less than length of head. *grandis* (192a).

BB. Depth of body greater than length of head. *simplex* (192b).

AA. 23-25 dorsal rays. *hippos* (192c).

- 192a. S. GRANDIS. Kingfish. *Seriola grandis* Castelnau, Proc. Zool. Soc. Viet. i, 1872, p. 114; *Id.* McCulloch, Biol. Res. Endeavour iii., 3, 1915, p. 121, pl. 35, 1 (Pl. xxi).

A large species which periodically moves along the coast in shoals. Its capture affords good sport for rod-fishermen, but it is of poor quality as a food-fish. Length 6 feet.

- 192b. S. SIMPLEX. *Id.* Ramsay & Ogilby, P.L.S.N.S.W. x, 1886, p. 757; *Id.* McCulloch, Biol. Res. Endeavour iii. 3, 1915, p. 123, pl. 37, 3.

Known only from the unique holotype, which was supposed to have been taken in Port Jackson.

- 192c. S. HIPPOS. SAMSONFISH. *Id.* Gunther, A.M.N.H. (4) xvii, 1876, p. 392; *Id.* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 71, pl. 9 (Pl. xxi).

Occurs plentifully off the coast where it is taken by line-fishermen. Length 2 feet.

193. TRACHINOTUS Lacepède. H.N. Poiss. iii, 1802, p. 78 (*falcatus*).

A. 23-26 dorsal rays; depth much less than half of length. *botla* (193a).

AA. 18-20 dorsal rays; depth greater than half of length. *ovatus* (193b).

- 193a. T. BOTLA. DART. *Scomber botla* Shaw, Gen. Zool. iv, 1803, p. 591. *T. botla* Ogilby, Mem. Qld. Mus. iii, 1915, p. 93, pl. 28 (Pl. xxii).

A tropical species wandering southward to Botany Bay. Length 22 inches.

- 193b. T. OVATUS. SNUB-NOSED DART. *Gasterosteus ovatus* Linn., Syst. Nat. 10th ed, 1758, p. 296. *T. ovatus* Ogilby, Mem. Qld. Mus. v, 1916, p. 154, pl. 19 (Pl. xxii).

A tropical fish which is not certainly known from New South Wales waters. Length 30 inches.

Trachinotus bailloni Lacepède, has been incorrectly recorded from New South Wales—see Ogilby, Mem. Qld. Mus. v. 1916, p. 149, pl. 18.

194. ELAGATIS Bennett, Narrat. Whaling Voy. ii, 1840, p. 283 (*bipinnulatus*).

- 194a. E. BIPINNULATUS. RUNNER. *Seriola bipinnulata* Quoy & Gaimard, Voy. Uranie, 1824, p. 363, pl. 61, 3. *E. bipinnulatus* Stead, Add. Fish. Faun. N.S. Wales, 1907, p. 17, pl. 5 (Pl. xxii).

A single specimen, about 27 inches long, was captured off Port Jackson.

195. *SCOMBEROIDES* Lacépède, H. N. Poiss. iii, 1801, p. 50 (*commersonianus*).
 195a. *S. SANCTI-PETRI*. LEATHERSKIN. *Chorinemus sancti-petri* Cuv. & Val.,
 H. N. Poiss, viii, 1831, p. 379, pl. 236 (Pl. xxi.).
 Not common in New South Wales waters. Length 20 inches.

LXXXVIII.

Family CORYPHAENIDAE.

196. *CORYPHAENA* Linn., Syst. Nat. 10th Ed., 1758, p. 261 (*hippurus*).
 196a. *C. HIPPURUS*. DOLPHIN. *Id.* Linn., *Tom cit.*; *Id.* Day, Fish. India,
 1876, p. 248, pl. 53, 6 (Pl. xxiii.).
 An oceanic species ranging over all warm seas. Length 6 feet.

LXXXIX.

Family BRAMIDAE.

197. *BRAMA* Bloch & Schneider, Syst. Ichth., 1801, p. 98 (*raii*).
 197a. *B. RAIL*. *Sparus raii* Bloch, Ausl. Fische v, 1791, p. 95, pl. 273. *B.*
raii McCoy, Prodr. Zool. Viet. dec. xiv, 1887, pl. 133 (Pl. xxiii.).
 The only record of this species from New South Wales is unsatisfactory, but
 the fish is widely distributed, and probably occurs on the coast. Length 30 inches.

XC.

Family CENTROPOMIDAE.

- A. Dorsal spines increasing in height backwards; scales in about 50 rows. *Glaucosoma* (198).
 AA. Posterior dorsal spines shorter than the anterior; scales in about 30 rows. *Ambassis* (199).
 198. *GLAUCOSOMA* (Temm. & Schleg.) Richardson, Ichth. Erebus & Terror, 1846,
 p. 27 (*burgeri*).
 198a. *G. SCAPULARE*. PEARL PERCH. *Id.* (Ramsay) Macleay, P.L.S.N.S.W.
 v, 1881, p. 334, pl. 13. *Id.* Roughley, Fish. Austr., 1916, p. 83, pl. 25
 (Pl. xxiii.).
 A deeper water species occurring on the northern portions of the coast.
 Length 2 feet.
 199. *AMBASSIS* Cuv. & Val., H. N. Poiss. ii, 1829, p. 176 (*ambassis*).
 A. Lateral line complete. *jacksoniensis* (199a).
 AA. Lateral line interrupted or obsolete. Subgenus *Priopis*.
 B. 10-11 dorsal and anal rays; marine. *ramsayi* (199b).
 BB. 7-8 dorsal and anal rays; fresh water.
 C. Eye shorter than postorbital part of head; fins plain. *castelnaui* (199c).
 CC. Eye as long as postorbital part of head; dorsals and ventrals tipped
 with black. *agassizi* (199d).
 199a. *A. JACKSONIENSIS*. *Id.* Macleay, P.L.S.N.S.W. v, 1881, p. 340.
 A small fish assembling in schools around wharf-piles in inlets along the
 coast. Length 2½ inches.
 199b. *A. RAMSAYI*. *Pseudoambassis ramsayi*, Macleay, P.L.S.N.S.W. v,
 1881, p. 340. *Priopis ramsayi* McCulloch, Biol. Res. Endeavour i. 1,
 1911, p. 57, pl. 16, 3 (Pl. xxiii.).
A. buruensis Bleeker, has been included in a New South Wales list by Waite
 (Mem. N.S. Wales Nat. Club ii, 1904, p. 29). The record is perhaps based upon
 specimens of *A. ramsayi*, the two species being very similar.

199c. A. CASTELNAUL. *Pseudoambassis castelnaui* Macleay, P.L.S.N.S.W. v, 1881, p. 339.

A fresh water species occurring in the Murray River system. Length $3\frac{1}{2}$ inches.

199d. A. AGASSIZ. CHANDA PERCH. *Id.* Steindachner, Sitzb. Akad. Wiss, Wien lv. i, 1867, p. 9.

A minute species ranging over south-eastern Queensland and the northern coastal rivers of New South Wales. Length $2\frac{1}{2}$ inches.

XCI.

Family ARRIPIDIDAE.

200. ARRIPIS Jenyns, Zool. Beagle iii, 1840, p. 13 (*georgianus*).

A. 13-14 dorsal rays. *georgianus* (200a).

AA. 15-17 dorsal rays. *trutta* (200b).

200a. A. GEORGIANUS. *Centropristis georgianus* Cuv. & Val., H. N. Poiss. vii, 1831, p. 451. *A. georgianus* McCoy, Prodr. Zool. Viet. dec. xix, 1889, pl. 184.

A southern species which has been recorded from Port Jackson. Length 16 inches.

200b. A. TRUTTA. AUSTRALIAN SALMON. *Sciaena trutta* (Forster) Bloch & Schneider, Syst. Ichth., 1801, p. 542. *Centropristis salar* Richardson, Ichth. Erebus & Terror, 1845, p. 29, pl. 20, 4-6 (Pl. xxiii.).

One of the most plentiful of our food-fishes, moving along the coast in huge shoals. Length 30 inches.

XCII.

Family LUTIANIDAE.

201. LUTIANUS Bloch, Ausl. Fische iv, 1790, p. 105 (*lutianus*).

A. Nape of head scaly, the scales extending forward to between eyes. *kasmira* (201g).

AA. Nape of head largely naked, interorbital area naked.

B. Eleven dorsal spines.

C. Soft dorsal pointed, the rays longer than the spines.

D. 13-14 dorsal, and 8-9 anal rays. *macleayanus* (201c).

DD. 16-17 dorsal, and 10-11 anal rays. *sebae* (201e).

CC. Soft dorsal rounded, the rays shorter than the spines.

amabilis (201f).

BB. Ten dorsal spines.

E. A large dark spot on the lateral line.

F. 13 dorsal rays; dark spot largely below lateral line.

fulviflamma (201b).

FF. 14-15 dorsal rays; dark spot largely above lateral line.

EE. Body nearly uniform, no dark spot on lateral line. *russelli* (201a).

superbus (201d).

201a. L. RUSSELLI. MOSES PERCH. *Mesoprion russelli* Bleeker, Verh. Bat. Gen. xxii, 1849, p. 41. *Lutjanus russelli* Bleeker, Atlas Ichth. viii, 1876, p. 71, pl. 300, 2.

A tropical species, occurring on the northern coast of the State. Length about 14 inches.

201b. L. FULVIFLAMMA. BLACK-SPOTTED SEA PERCH. *Sciaena fulviflamma* Forskal, Descr. Anim., 1775, p. 45. *Lutjanus fulviflamma* Bleeker, Atlas Ichth. viii, 1876, p. 65, pl. 344, 3 (Pl. xxiii.).

This species is very similar to the preceding.

- 201c. L. MACLEAYANUS. *Genyoroge macleayana* Ramsay, P.L.S.N.S.W. viii. 1, 1883, p. 178.

A rare species known from a single specimen over 2 feet long.

- 201d. L. SUPERBUS. PURPLE SEA PERCH. *Diacopus superbus* Castelnau, P.L.S.N.S.W. ii, 1878, p. 228. *Lutianus superbus* McCulloch, Mem. Qld. Mus. iii, 1915, p. 52, pl. 17.

Another little known species, but once recorded from the northern coast. Length about 2 feet.

- 201e. L. SEBAE. KING SNAPPER OR GOVERNMENT BREEM. *Diacope sebae* Cuv. & Val., H. N. Poiss. ii, 1828, p. 411. *Lutjanus sebae* Bleeker, Atlas Ichth. viii, 1876, p. 62, pl. 350, 2.

A brilliantly coloured and prized table fish, attaining a weight of 48 pounds. It is widely distributed in the tropics, and enters our waters on the north coast.

- 201f. L. AMABILIS. YELLOW-BANDED HUSSAR. *Genyoroge amabilis* De Vis, P. Roy. Soc. Qld. i, 1884, p. 145. *Lutianus amabilis* McCulloch, Mem. Qld. Mus. iii, 1915, p. 53, pl. 18 (Pl. xxiii.).

Another beautifully coloured and fine edible fish, reaching a length of 18 inches.

- 201g. L. KASMIRA. BLUE-BANDED HUSSAR. *Sciaena kasmira* Forskal, Descr. Anim., 1775, p. 46. *Lutjanus bengalensis* Bleeker, Atlas Ichth. viii, 1876, p. 55, pl. 333, 4.

A smaller species, ornamented with brilliant blue bands. Length 10 inches.

202. ETELIS Cuvier & Valenciennes, H. N. Poiss. ii, 1828, p. 127 (*carbunculus*).
202a. E. sp. *Id.* Gunther, Challenger Zool. i, 1880, p. 27.

Young examples $2\frac{1}{2}$ inches long, from deep water, may prove to be referable to *E. carbunculus*.

203. APRION. Cuv. & Val., H. N. Poiss. vi, 1830, p. 544 (*virescens*).

- 203a. A. ROSEUS. *Aphareus roseus* Castelnau, P.L.S.N.S.W. iii, 1879, p. 373. *Aprion roseus* McCulloch, Rec. Austr. Mus. xi. 7, 1917, p. 173, pl. 30 (Pl. xxiii.).

A tropical species, occurring on the northern part of the coast, and reaching a length of at least 18 inches. It is perhaps the adult stage of *A. microlepis* Bleeker.

XCIII. Family NEMIPTERIDAE.

204. NEMIPTERUS Swainson, Nat. Hist. Classif. Fish. Rept. Amphib. ii, 1839, p. 223 (*filamentosus*).

- 204a. N. THEODOREL. BUTTERFLY BREEM. *Id.* Ogilby, P. Roy. Soc. Qld. xxviii, 1916, p. 113 and Mem. Qld. Mus. vi, 1918, p. 55, pl. 19 (Pl. xxiv.).

Specimens submitted for sale in the Sydney markets probably came from the northern part of the coast. Length about 12 inches.

XCIV. Family ERYTHRICHTHYIDAE.

205. EMMELICHTHYS Richardson, Ichth. Erebus & Terror, 1845, p. 47 (*nitidus*).

- 205a. E. NITIDUS. *Id.* Richardson, *Tom. cit.*, pl. 29, 7-8 (Pl. xxiv.).

A rare species which has been recognised from this State in association with shoals of Pilehards. Length, 14 inches.

XCV.

Family LOBOTIDAE.

206. LOBOTES Cuvier, R. Anim. 2nd ed., ii, 1829, p. 177 (*surinamensis*).

206a. L. SURINAMENSIS. TRIPLE-TAIL. *Holocentrus surinamensis* Bloch, Ausl. Fische iv, 1790, p. 98, pl. 243. *Lobotes surinamensis* Bleeker, Atlas Ichth. viii, 1876, p. 12, pl. 311, 4 (Pl. xxiv.).

An excellent food-fish, growing to 30 inches long, which wanders southward from the tropics into our northern waters.

XCVI.

Family POMADASIDAE.

A. A central groove behind the symphysis of the lower jaw. *Pomadasys* (207).

AA. No such groove.

B. 13 dorsal spines; scales in 65 or more rows below the lateral line.

Plectorhinchus (208).

BB. 14 dorsal spines; scales in 50 rows below the lateral line.

Euelatichthys (209).

207. POMADASYs Lacep., H. N. Poiss. iv, 1802, p. 515 (*argenteus*).

207a. P. HASTA. JAVELIN FISH. *Lutjanus hasta* Bloch, Ausl. Fische iv, 1790, p. 109, pl. 246, l. *Pomadasys hasta* Bleeker, Atlas Ichth. viii, 1876, p. 28, pl. 325, 3 (Pl. xxiv.).

An excellent food-fish, growing to at least 2 feet long. It is common in Queensland, and ranges into the northern waters of New South Wales.

208. PLECTORHINCHUS Lacep., H. N. Poiss. iii, 1802, p. 134 (*chaetodonoides*).

A. 9-10 dorsal spines.

pictus (208b).

AA. 13 dorsal spines.

reticulatus (208a).

208a. P. RETICULATUS. *Diagramma reticulatum* Gthr., Brit. Mus. Cat. Fish. i, 1859, p. 334. *Plectorhynchus reticulatus* McCulloch, Biol. Res. Endeavour iv. 4, 1916, p. 185, pl. 53 (Pl. xxiv.).

A little known species, but once recorded from New South Wales waters.

208b. P. PICTUS. GOLDEN-SPOTTED SWEETLIPS. *Perca picta* Thunberg, Nya.

Handl. Stockholm xiii, 1793, p. 141, pl. 5, l. *Plectorhynchus pictus* Bleeker, Atlas Ichth. viii, 1876, p. 24, pl. 329, 4.

An indifferent food-fish, reaching a length of two feet. It has been recorded from the Tweed River Heads as *Spilotichthys labiosus*.

209. EUELATICHTHYS Fowler, Journ. Acad. N. Sci. Philad. (2) xii, 1904, p. 527 (*affine*).

209a. E. NIGER. BROWN SWEETLIPS. *Pristipoma niger* (Mertens) Cuv. & Val., v, 1830, p. 258. *Plectorhynchus crassispinis* Bleeker, Atlas Ichth. viii, 1876, p. 15, pl. 342, l. (Pl. xxiv.).

A well flavoured species, growing to over 2 feet long, and occurring on the northern portion of the coast.

XCVII.

Family GERRIDAE.

210. GERRES (Cuvier) Quoy & Gaimard, Voy. Uranie, 1824, p. 293 (*vaigiensis*).

A. About 36 scales on the lateral line.

B. Colouration uniformly silver.

ovatus (210a).

G. subfasciatus, with indistinct vertical bands, is apparently near *G. ovatus*.

AA. About 45 scales on the lateral line.

argyreus (210c).

- 210a. *G. OVATUS*. SILVERBELLY. *Id.* Gthr., Brit. Mus. Cat. Fish. i, 1859, p. 343. *Xystaema ovatum* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 83, pl. 13 (Pl. xxiv.).

Abundant in shallow waters and growing to 10 inches long.

- 210b. *G. SUBFASCIATUS*. *Id.* Cuvier & Valenciennes, H. N. Poiss. vi, 1830, p. 477.

A little known species, said to have been taken in Port Jackson.

- 210c. *G. ARGYREUS*. *Cichla argyrea* (Forster) Bloch & Schneider, Syst. Ichth. 1801, p. 344.

A tropical species straying into New South Wales waters.

XCVIII.

Family SCIAENIDAE.

- A. Precaudal vertebrae less numerous than those of caudal region; caudal fin convex posteriorly. *Sciaena* (211).

- AA. Precaudal vertebrae more numerous than those of caudal region; caudal fin slightly emarginate posteriorly *Atractoscion* (212).

211. *SCIAENA* Linn., Syst. Nat. 10th. ed., 1758, p. 289 (*umbra*).

- 211a. *S. ANTARCTICA*. JEWFISH. *Id.* Castelnau, P.Z.S. Vict. i, 1872, p. 100, fig. *S. hololepidota antarctica* Ogilby, Mem. Qld. Mus. vi, 1918, p. 70, pl. 21 (Pl. xxiv.).

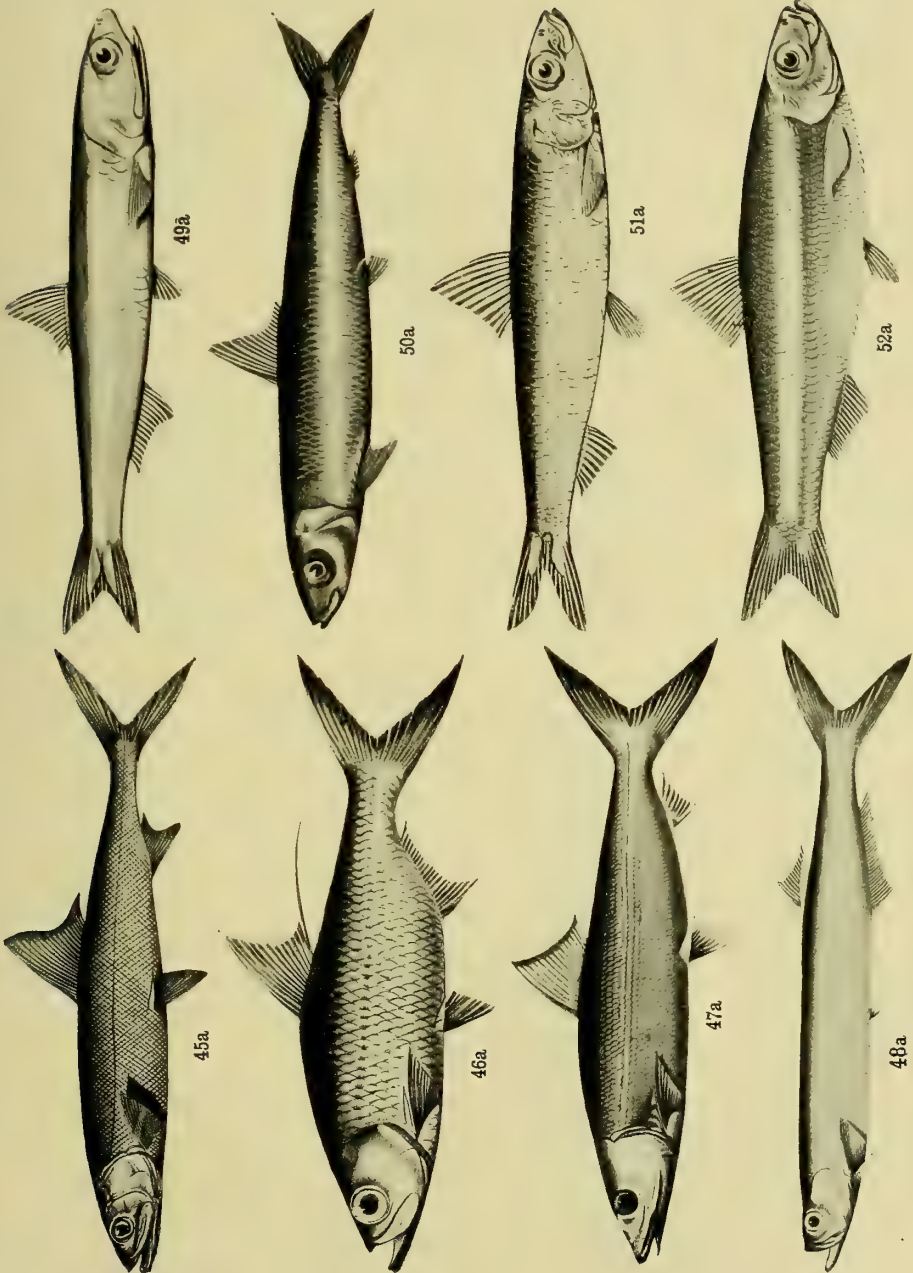
A most important food-fish, growing to a length of over 6 feet. It is perhaps identical with the Maigre of European waters.

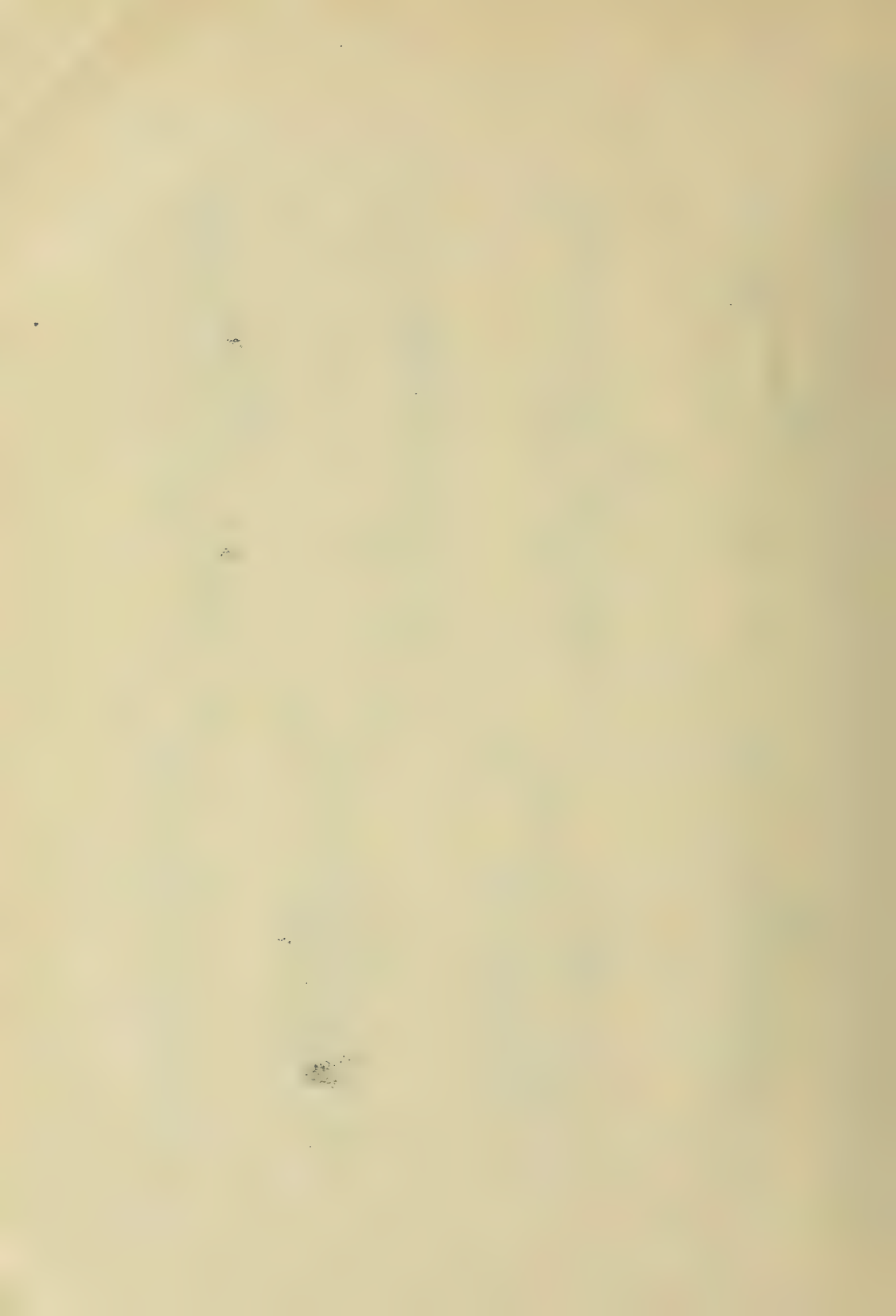
212. *ATRACTOSCION* Gill, P. Acad. N. Sci. Philad., 1862, p. 18 (*aequidens*).

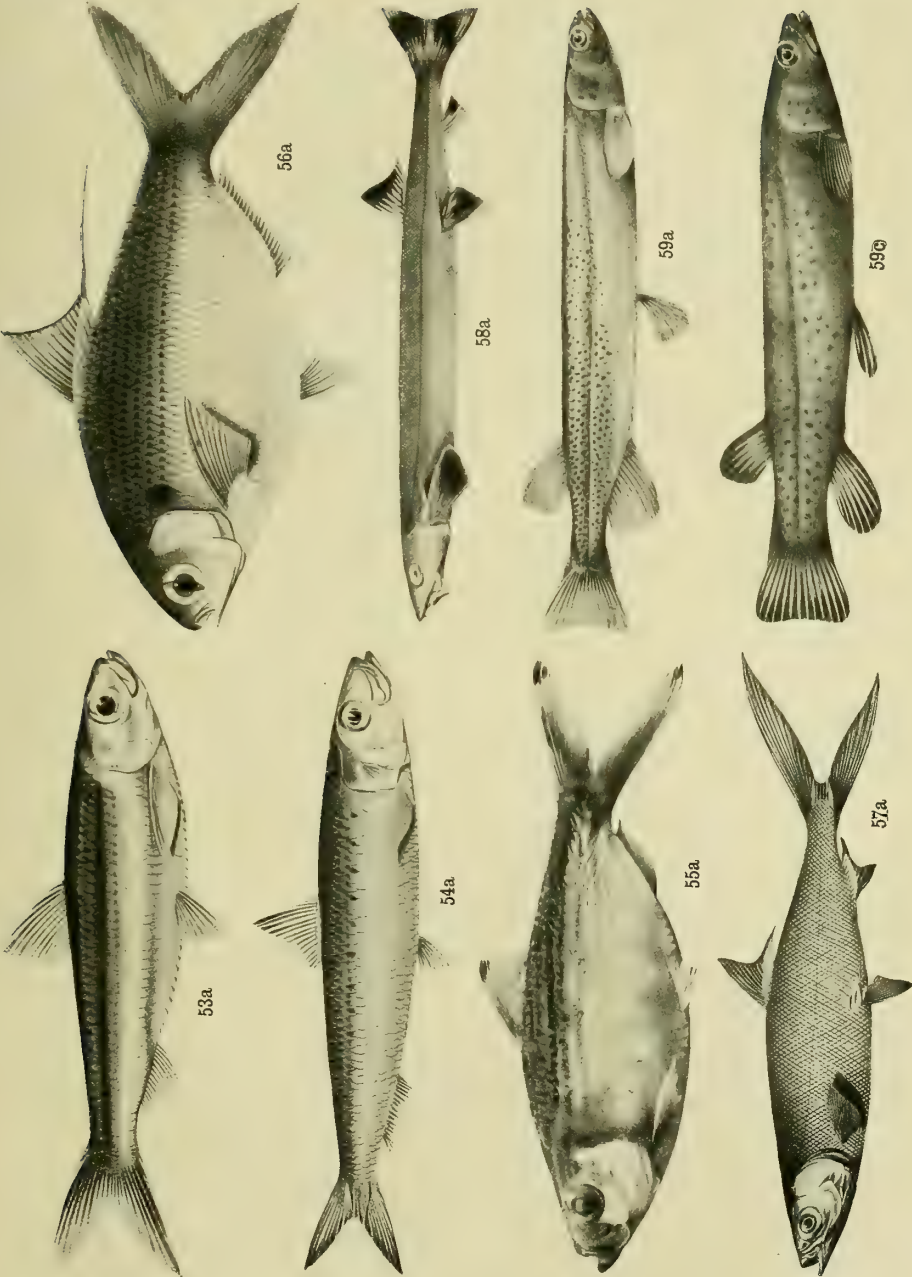
- 212a. *A. ATELODUS*. TERAGLIN. *Otolithus atelodus* Gunther, A.M.N.H. (3) xx, 1867, p. 60. *Cynoscion atelodus* Roughley, Fish. Austr., 1916, p. 115, pl. 36 (Pl. xxiv.).

A fine edible fish, sometimes occurring plentifully off the coast. Length 3 feet.

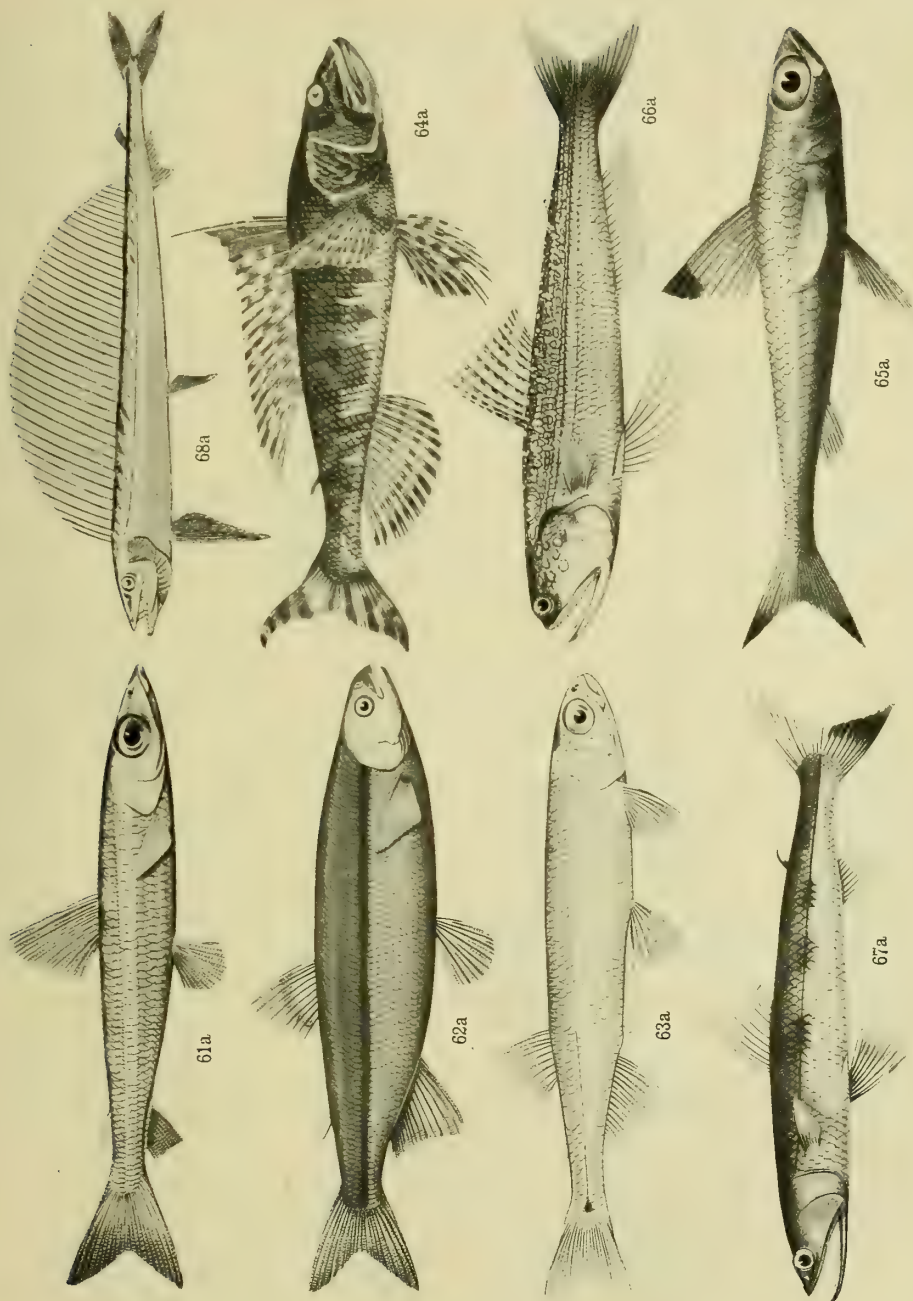
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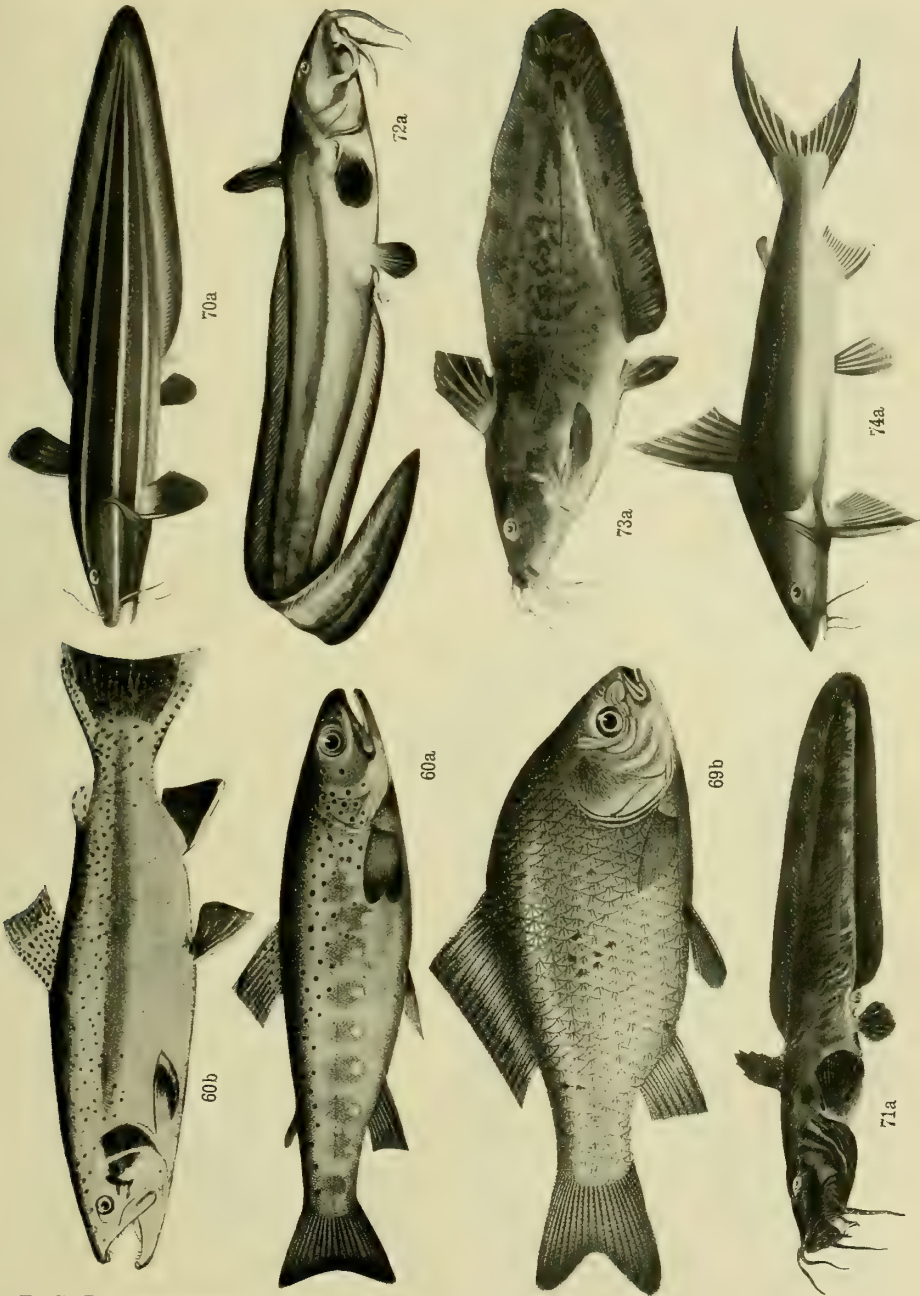




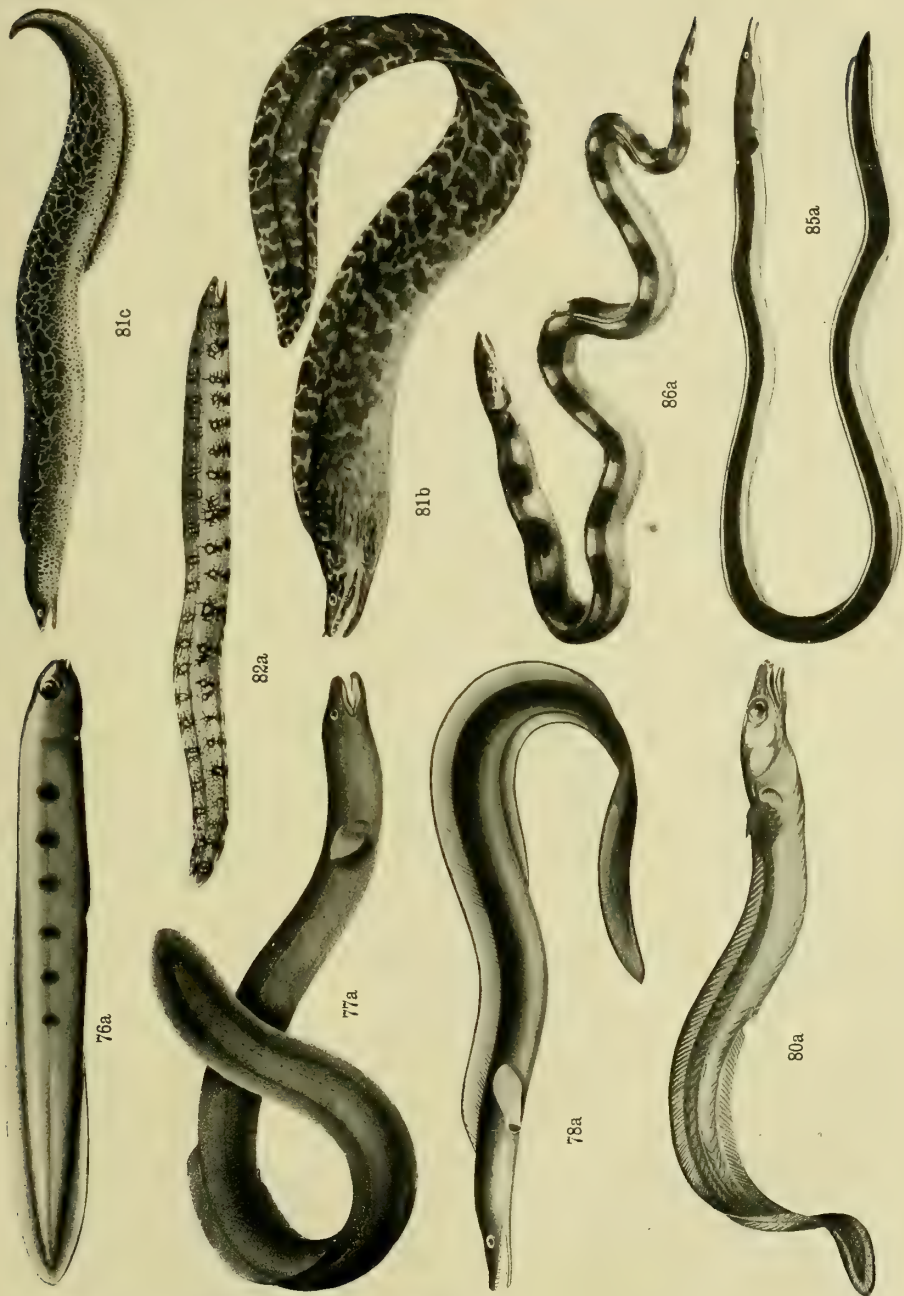


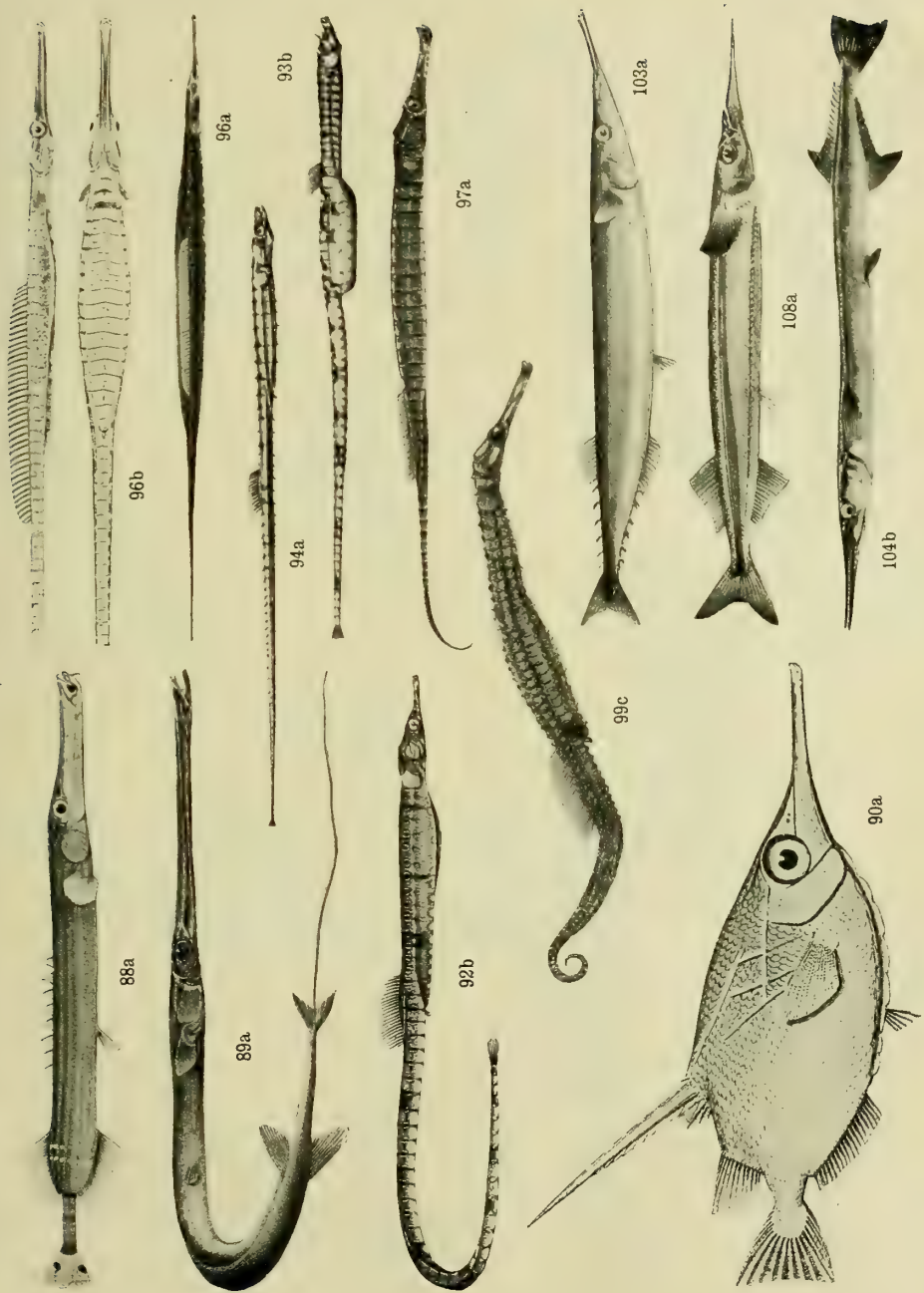
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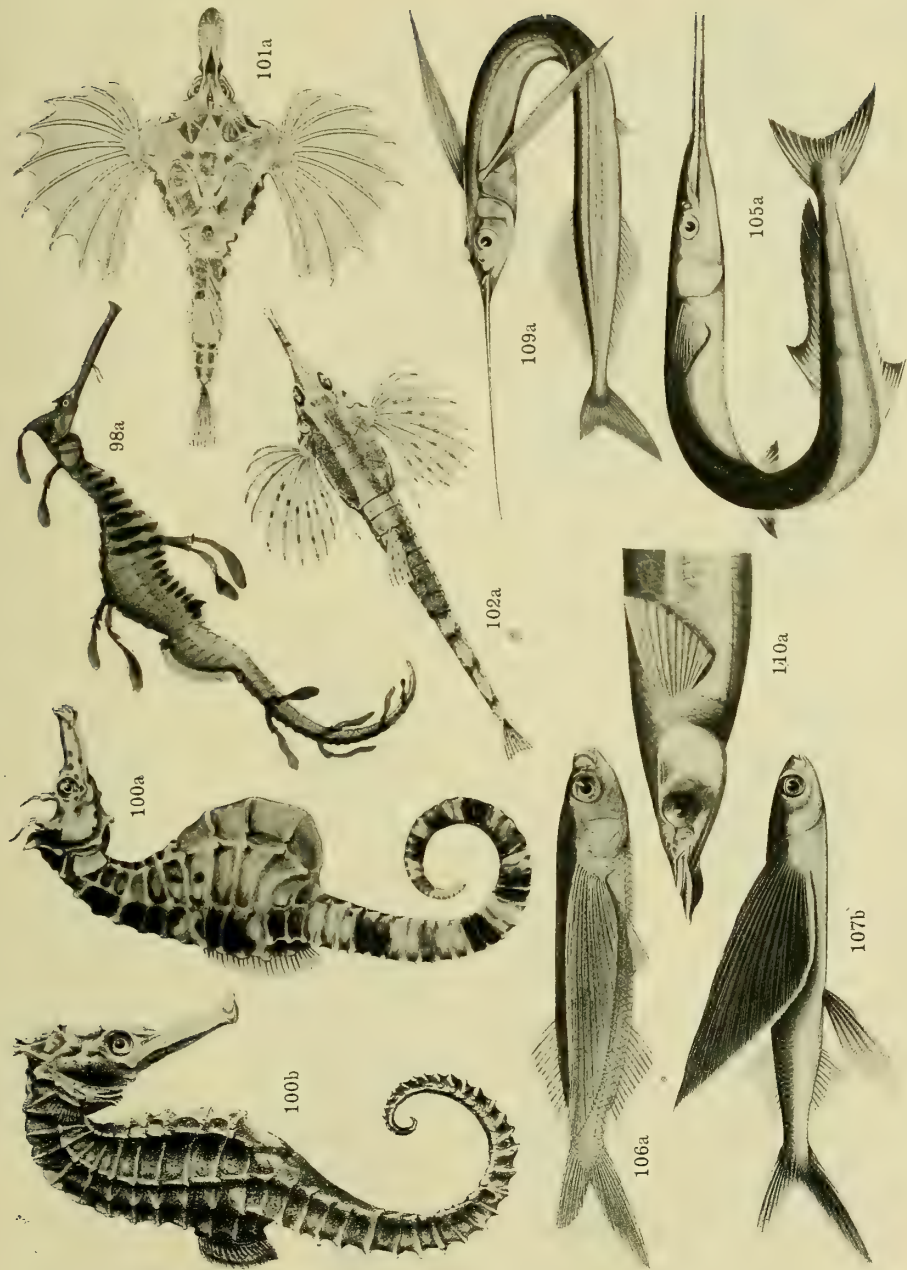




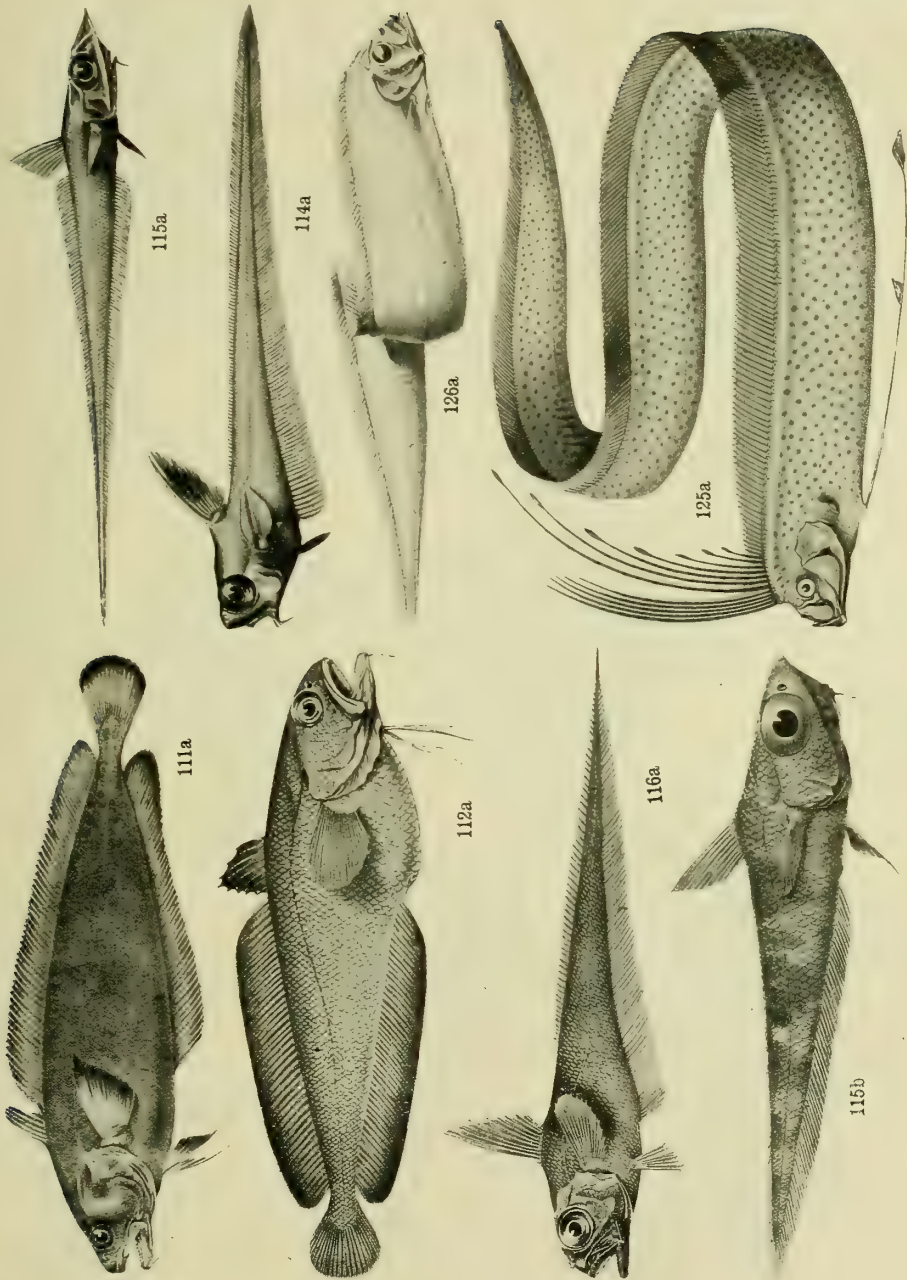
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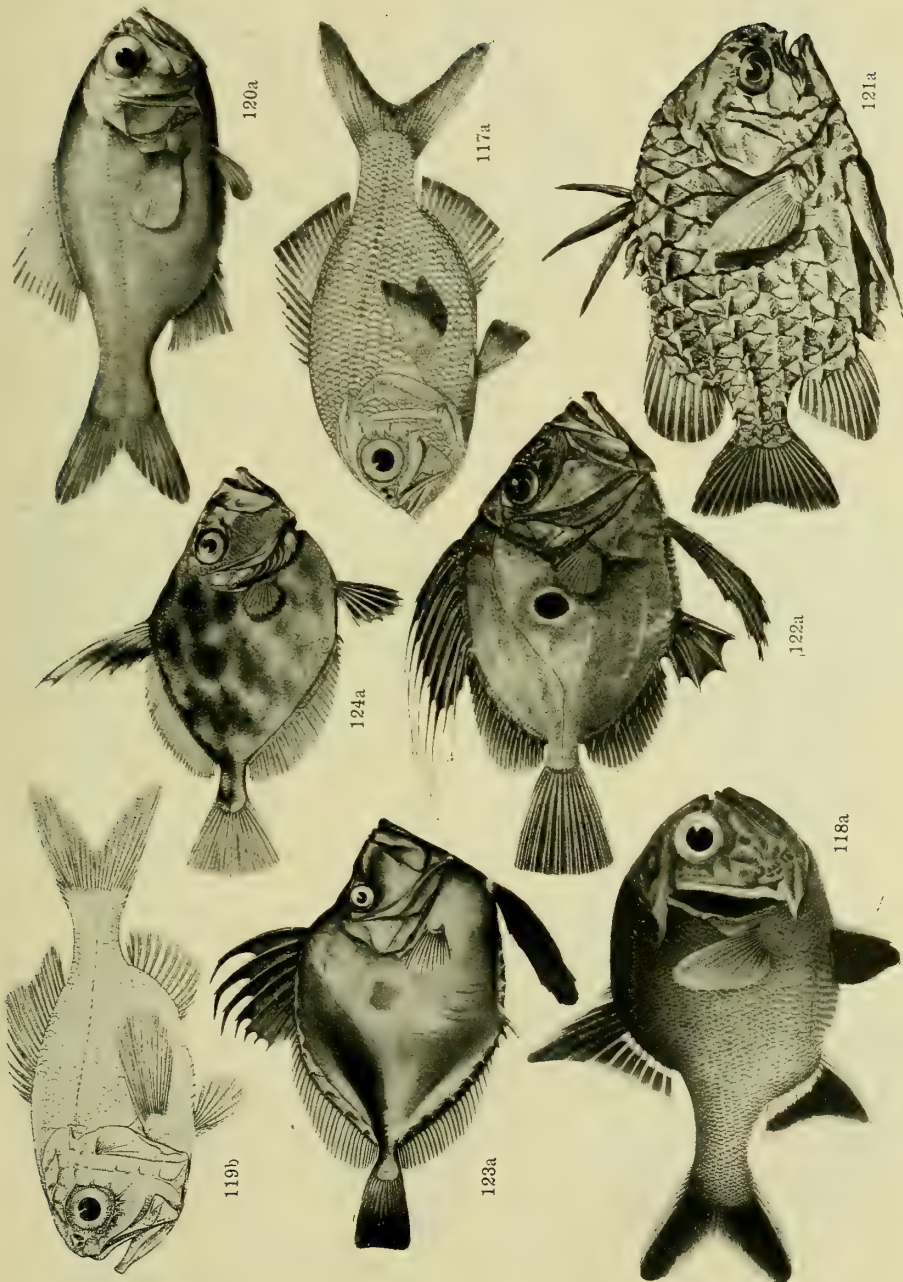


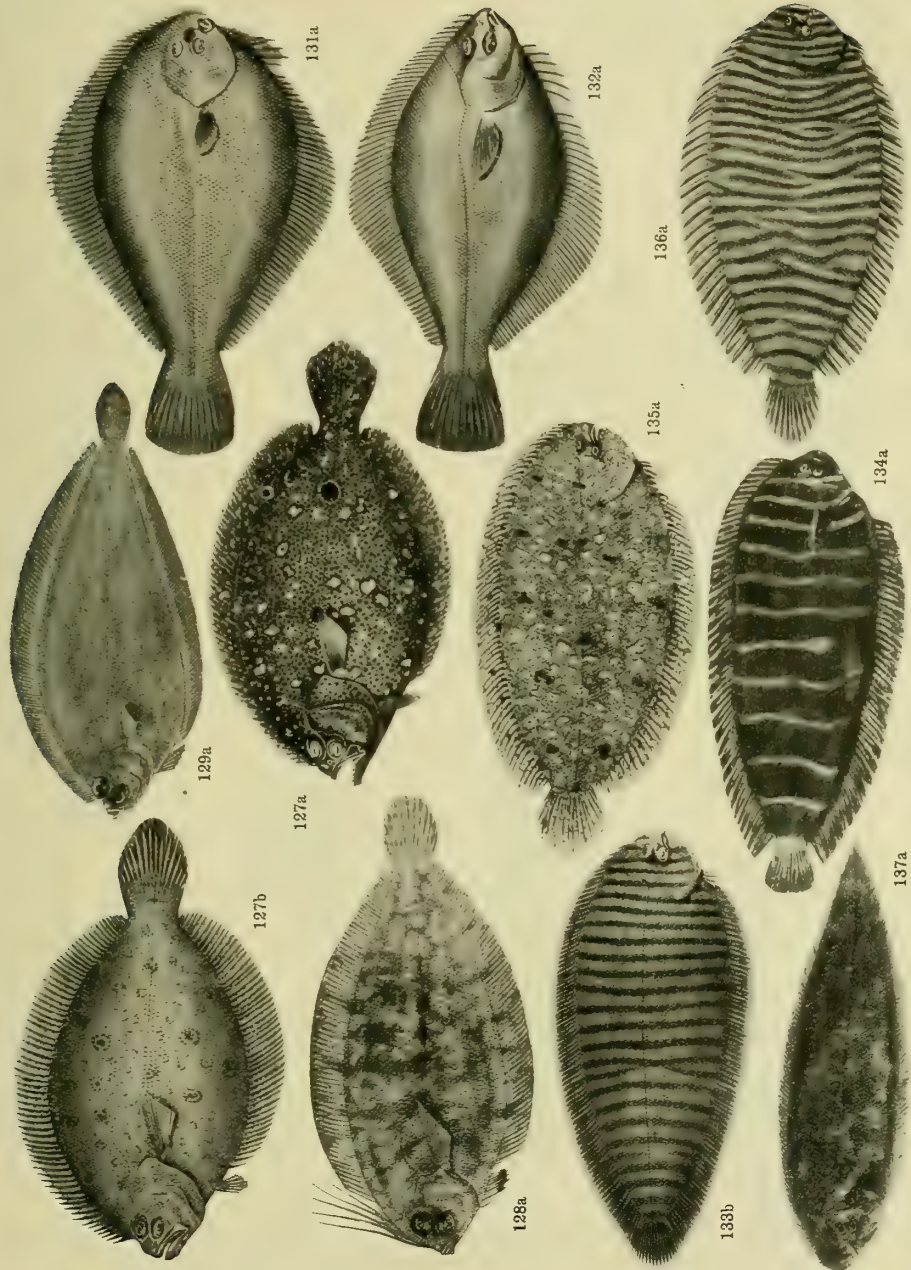


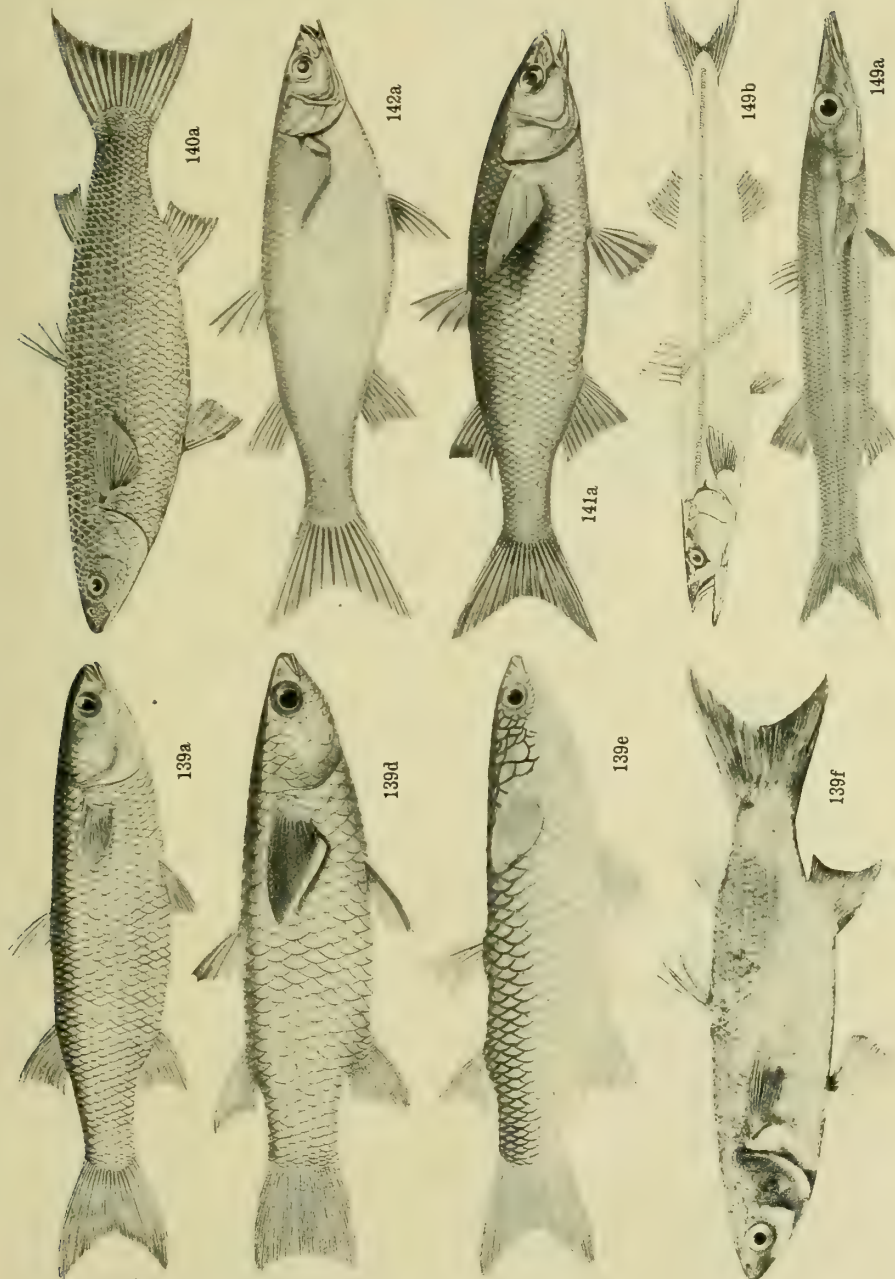


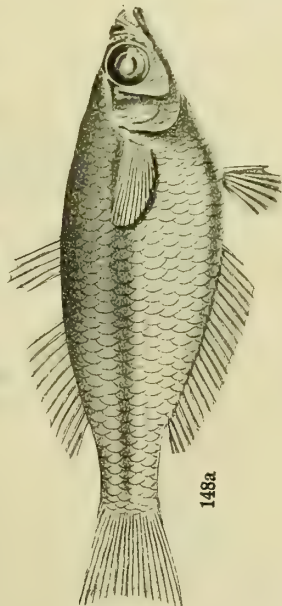
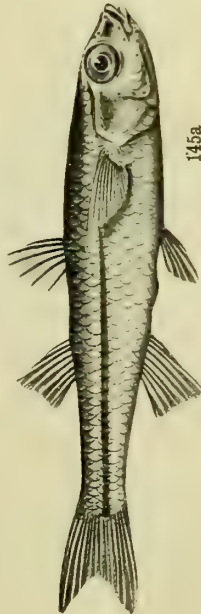
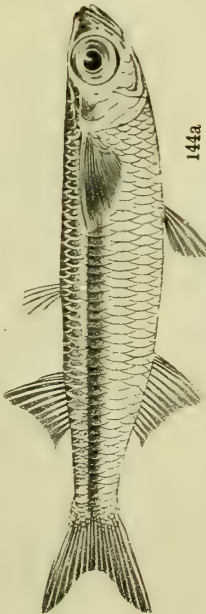
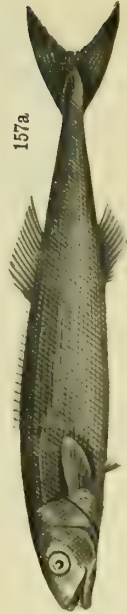
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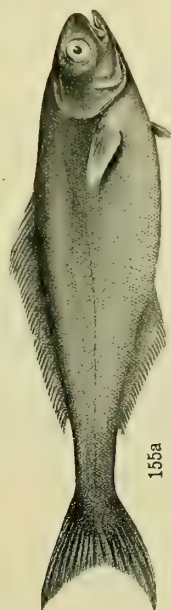
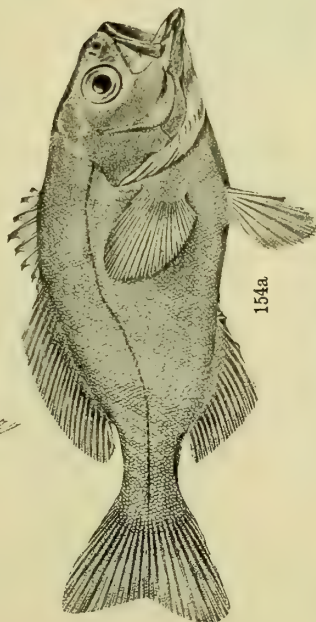
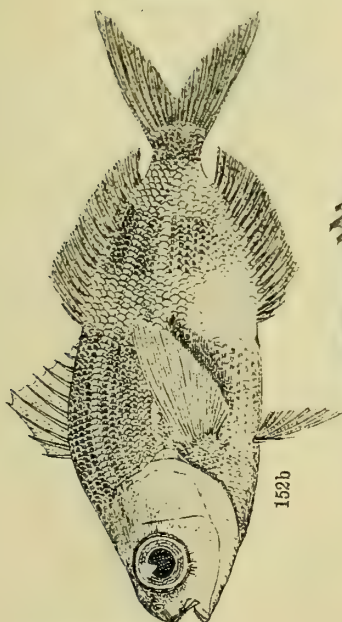


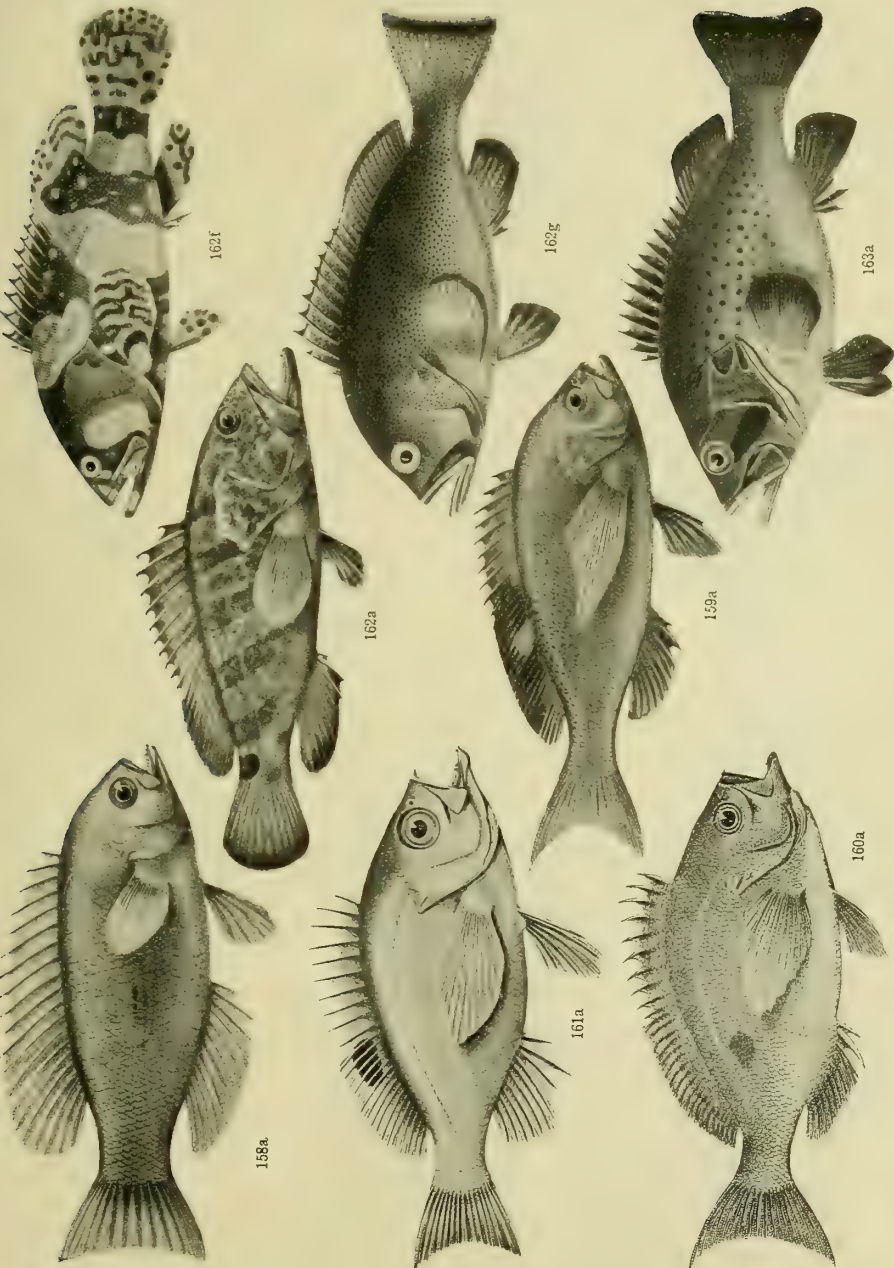






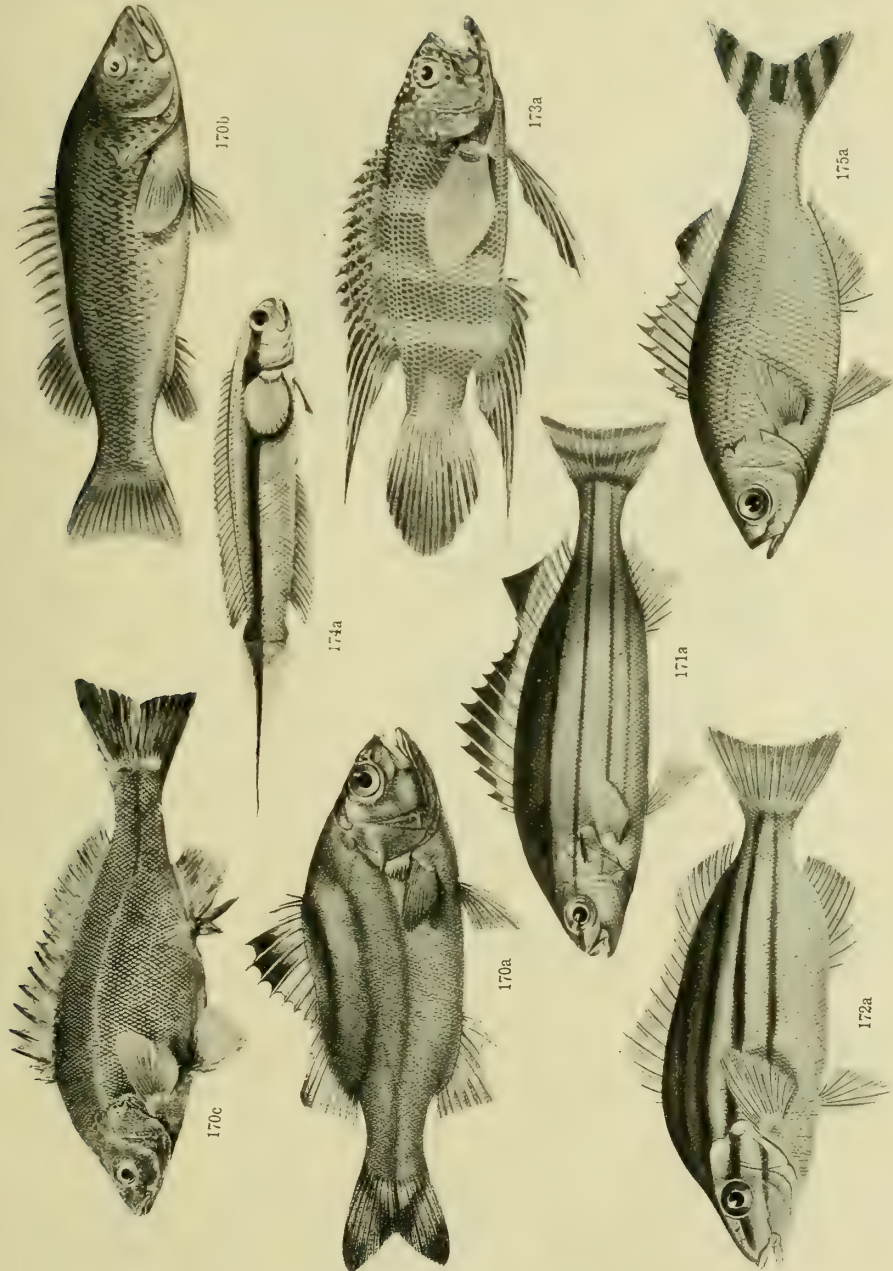


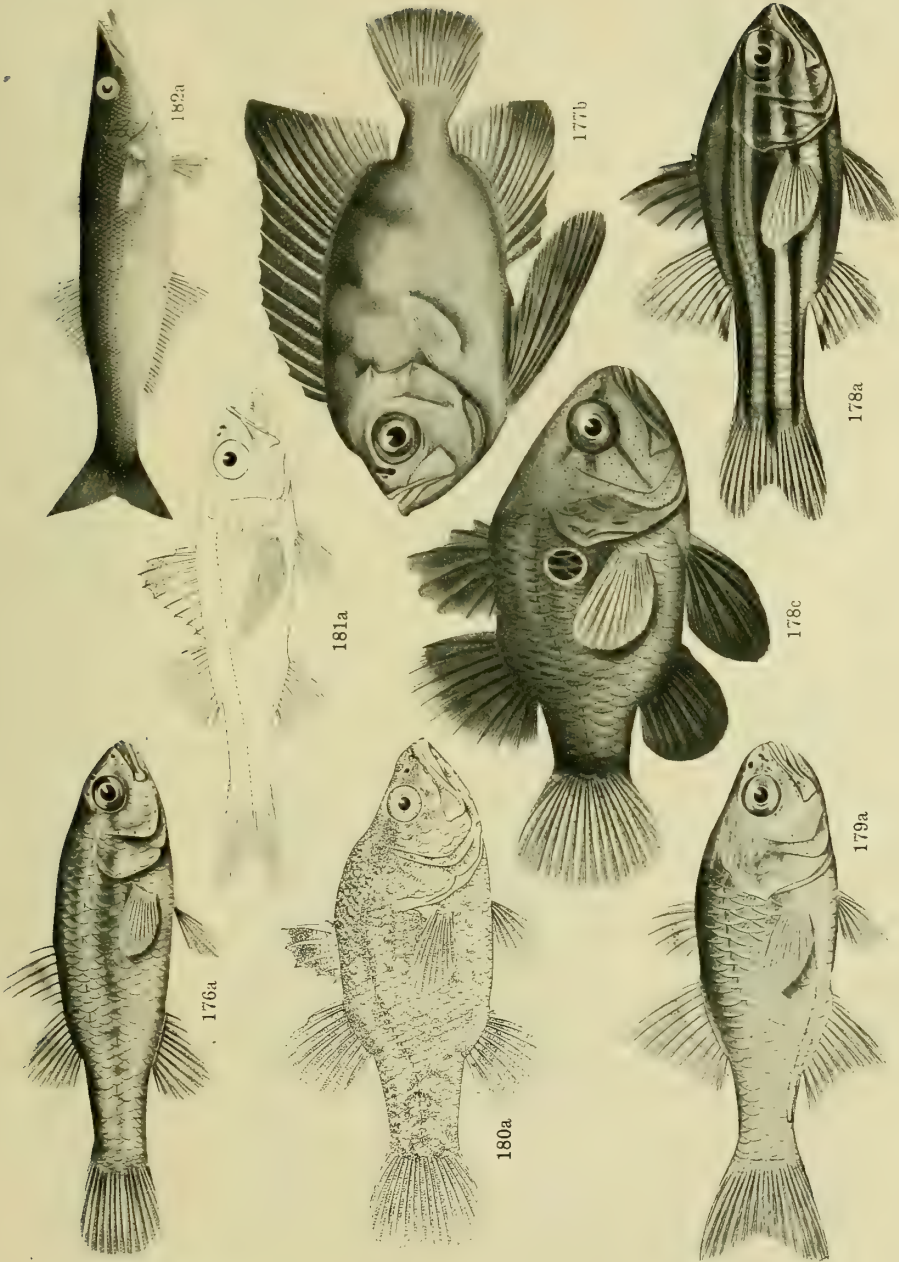


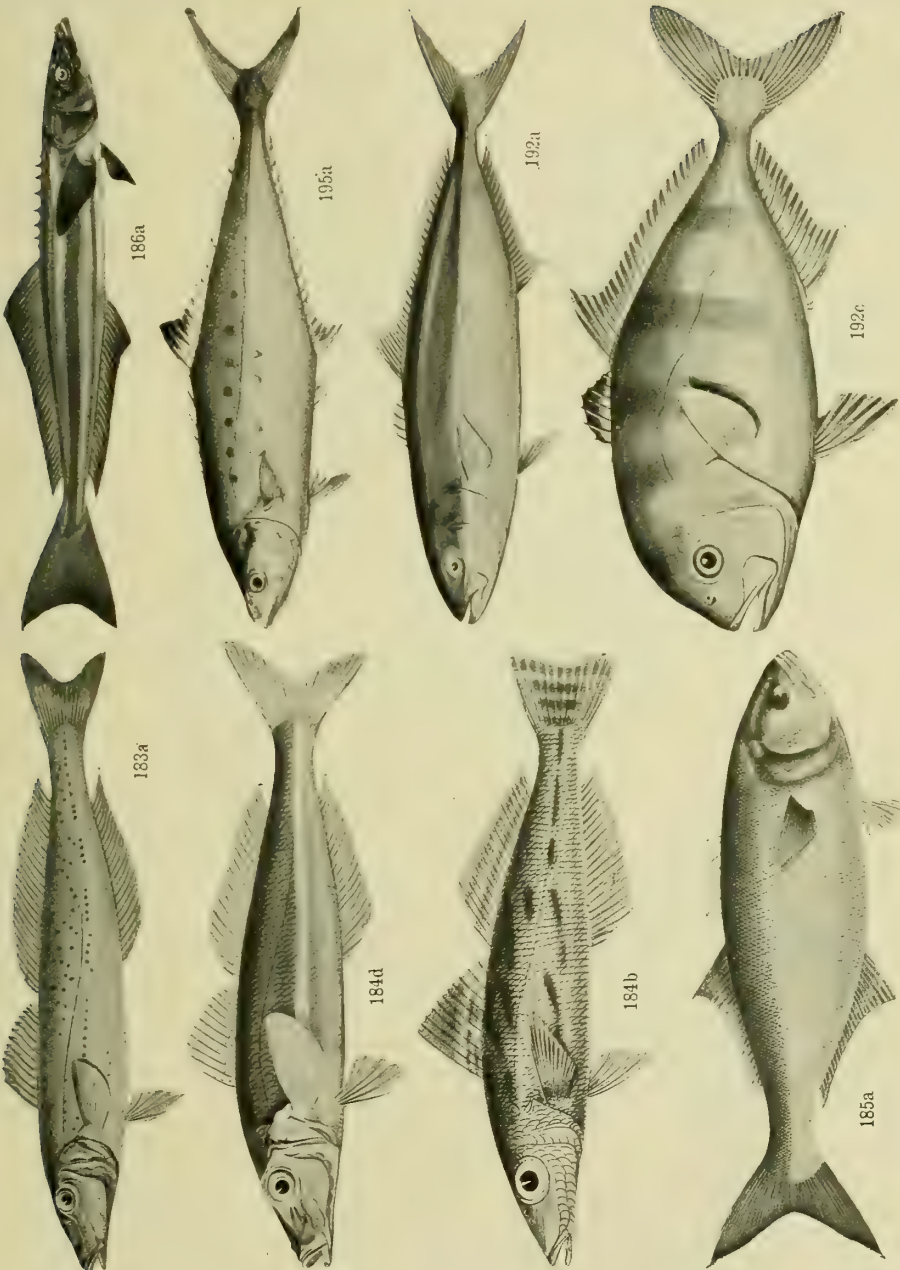


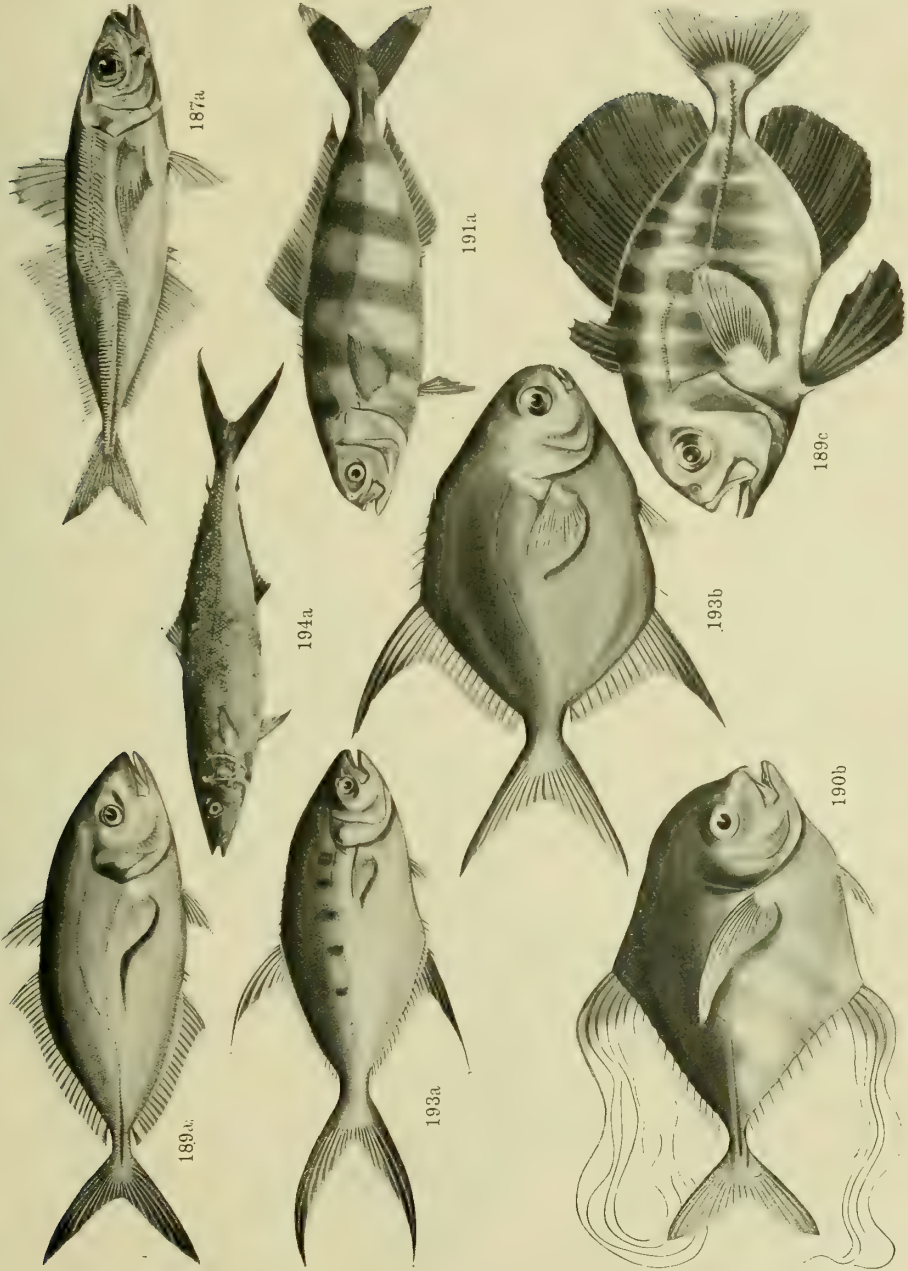
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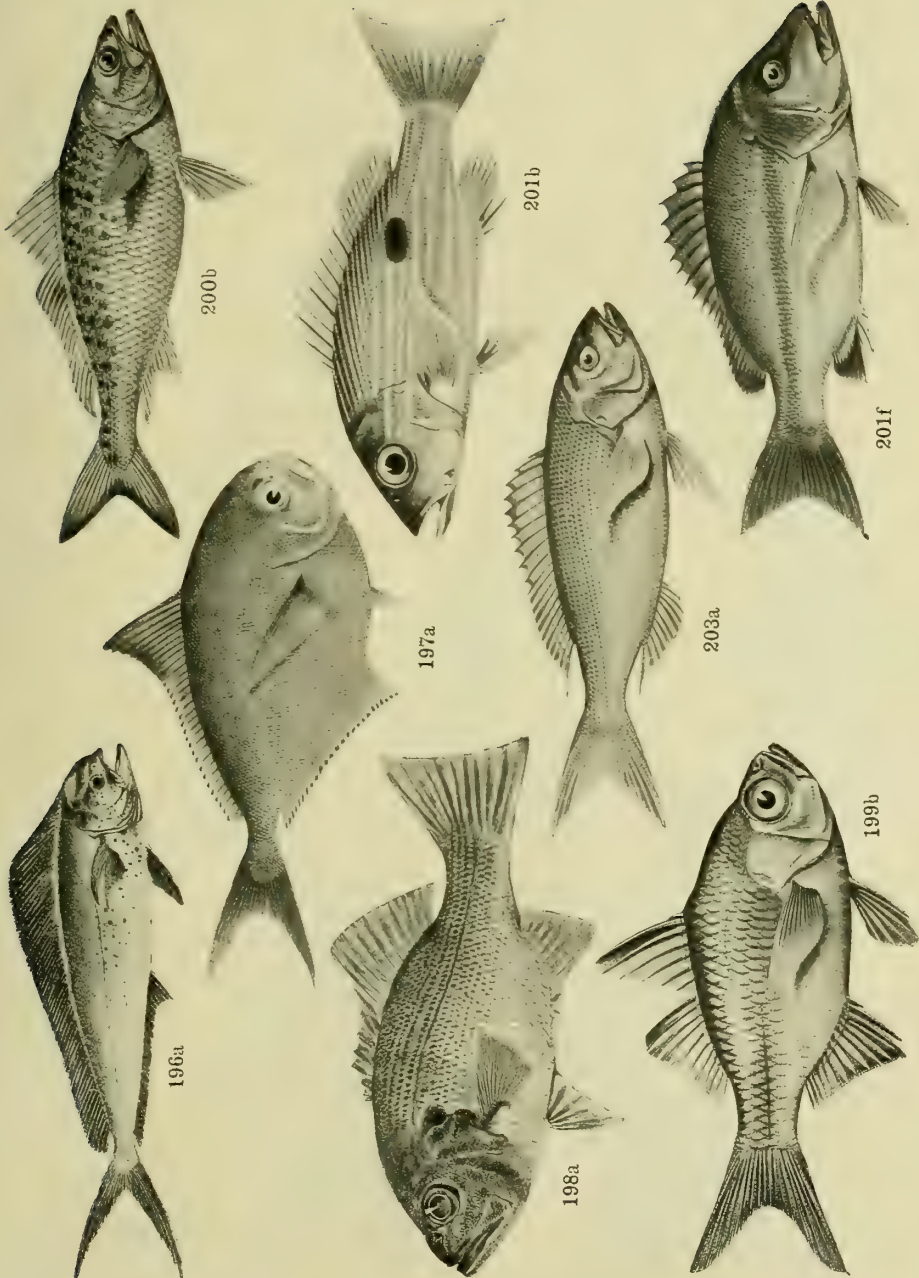


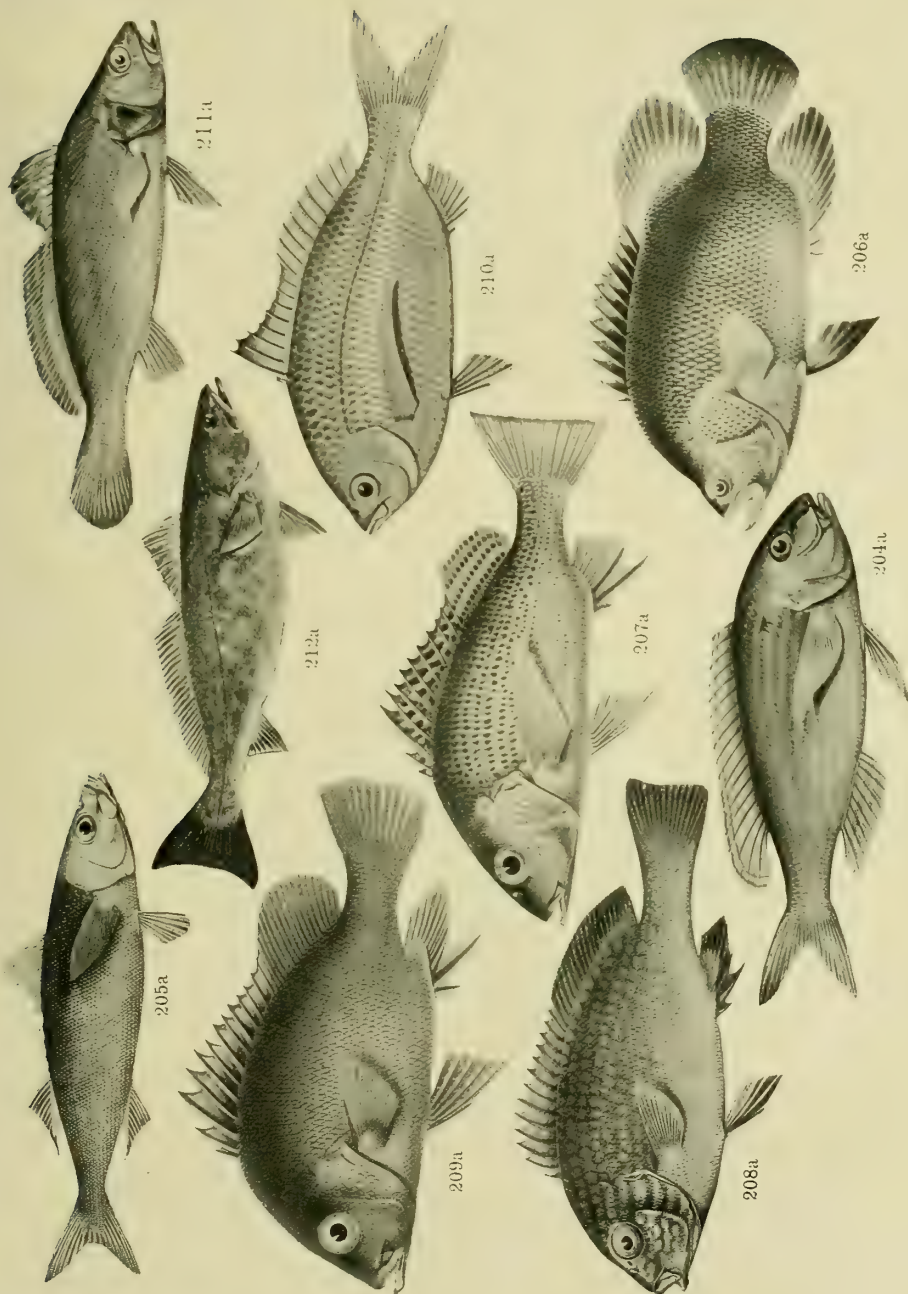












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THE AUSTRALIAN ZOOLOGIST

Issued by
The Royal Zoological Society of New South Wales

Edited by
LAUNCELOT HARRISON, B.Sc., B.A.,
Acting Professor of Zoology at the University of Sydney.

Vol. 2—Part 3
(Price, 10/.)

Sydney, February 10, 1922.

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Royal Zoological Society of New South Wales.

Established 1879.

REGISTERED UNDER THE COMPANIES ACT, 1899 (1917).

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Authors should state whether proofs and reprints are desired when submitting MS. Fifty reprints of any article appearing under a separate title will be supplied gratis. If more are required, terms may be ascertained on application to the Editor.

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Royal Zoological Society of New South Wales.

ANNUAL REPORT

OF THE

ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES.

1920-1921.

The fourth annual general meeting of the Society was held at Taronga Zoological Park on Saturday, 30th July, 1921, at 3 p.m.

Thirty five members were present.

The President (Dr. E. A. D'Ombain) read the following report:—

Membership.

The membership roll of the Society has steadily increased, the numbers enrolled, and financial, at the close of the year, being 291 ordinary, 8 honorary, and 39 associate members—a total of 338, as compared with 295 for the preceding year, an increase of 43 members.

The Council.

Eight meetings of Council were held during the year, the attendances at which were as follows:—Messrs. Waterhouse and Hull, 8; Drs. D'Ombain and Ferguson, and Mr. Finckh, 7; Messrs. Goldfinch, Musgrave and Campbell, 6; Messrs. Hedley, Halloran and McCulloch, 5; Mr. Shires, 4; Messrs. Froggatt, Harrison, Shipway and Symons, 3; Col. Spain, 1; Professor Johnston, nil.

Finances.

The Capital Fund has been increased by £100, and now stands at £445 5s. A substantial balance is carried to the credit of the General Account, but the Handbook Fund shows a reduction on account of printing plates for the forthcoming Handbook to the Fishes of New South Wales.

Australian Zoological Handbooks.

Owing to ill-health Mr. A. R. McCulloch has been unable to complete his work on the Fishes, but it is hoped to publish the final section shortly.

The Australian Zoologist.

Three numbers of this journal were issued during the year, Part 8 completing the first volume, and Parts 1 and 2 of Volume 2.

The Report and Balance Sheet were adopted.

The following members were elected to fill vacancies in the Council, in accordance with the provisions of Article 23:—Dr. E. A. D'Ombain, Dr. A. B. Walkom, Messrs. F. L. Rolin, W. C. Shipway, G. A. Waterhouse, and D. G. Stewart.

It was resolved that the thanks of the Society be accorded to Col. Spain and Mr. S. T. D. Symons, retiring members of Council who did not seek re-election, for their past services to the Society.

Short addresses with exhibits were given by Acting-Professor Launcelet Harrison, on the embryology of the platypus, and Mr. A. S. Le Souef on a nest-building rat from Nullarbor Plains, South Australia.

PRESIDENTIAL ADDRESS.

E. A. D'Ombraïn, M.B., B.S.

On the occasion of vacating the presidential chair after my year of office I would like to make a few remarks on the subject of Zoology and Zoologists.

I have discovered that if you tell the average citizen you are interested in Zoology or that you are a member of the Zoological Society, he at once assumes you are connected with the securing, eaging, care and study of Lions, Tigers, Snakes and rare birds and beasts generally, and foreign things in particular! Indeed, one person told me he supposed that I, as President of this Society, would have to do a lot of travelling in search of animals, etc!

It is here that I would like those who think that a Zoologist is a person with a special knowledge, to know that although a Zoologist may have scientific knowledge and attainments there are many thousands who have neither, and yet by virtue of their being interested in, and lovers of, natural history are actually Zoologists.

Since the earliest records of civilised man there have been those in all communities who, in their way, have been Zoologists. Such people as ancient historians show, were those who primarily were interested in animals (in which term I include birds), insects, reptiles, and living things generally.

The mere fact of securing these for either sport, or use, or curiosity, shows the interest such things aroused in the human mind, i.e., they were in a sense embryo Zoologists. Literature of the times of the ancients (Romans and Greeks, etc.), is full of references to these specimens of natural history, and naturally as man's intellect increased (and desire for knowledge in consequence), so there came to be those who devoted their time to the studying of appearance, habits, and later, structure of the various forms of life around them, and of those brought by travellers to the markets of the world.

At this time a great amount of the so-called "knowledge" was purely imaginary and made up of travellers' tales, which were often mere inventions. Later the interest increased to such an extent that "menageries" were set up, and so the mass of the public, all of whom were interested in these collections, had a means of satisfying their curiosity, and of increasing their knowledge. I maintain, therefore, that in their way these were all Zoologists.

We may take it then, that after the collections of living forms came the desire to preserve the dead ones and these early efforts resulted in the establishment of small collections probably privately owned. The study of the Alchemist, for instance, is always depicted with stuffed specimens of reptiles, birds, and small animals. From these it was but a step to the larger collections until, in the 16th century, the Italian universities showed collections and the study of Zoology began in earnest.

The earliest surviving museum was founded at Naples, but was for some time suppressed by the Church!

Later, some fifty years, Oxford University founded a museum of natural history, following on the plan of the one at Naples.

So the study began to be a recognised entity and as the people turned their attention more and more to the absorbing interest of the creations of Nature, so accordingly arose the men and teachers who placed it on a sound scientific basis, giving all things a name, often meaning, or referring to, a characteristic and so the apparently "long names" that the non-scientific are prone to consider as "jaw-breakers" came into being.

In the early part of the 18th century (1707) was born Linnaeus, who has been called the Adam of Zoology—Linnaeus set to work and evolved a method of Classifying all living things of the world, and by this and his enumeration brought order out of chaos.

From this time on the study never looked back and the giants of Zoological intellect have since been many in the land. To mention just two or three, Darwin, Huxley, Owen, Haeckel, etc., will suffice.

These bring us up to the 19th and 20th centuries, in which we find that almost every other person in civilised communities knows something, however small, of Zoological fact, and almost every large town or city has its private or public collection of stuffed or preserved specimens and every important city its Zoological Gardens.

As an outcome of all the general study there naturally arises the person who is attracted by one branch more than another and thus we have the specialist. Sometimes, as in all special walks in life, the person who becomes such, knows very little of the broader walks around him. At other times one with a broad general knowledge of Zoology, will specialise in some branch exclusively. Now my reason for drawing attention to these facts is to examine the present administrations of public collections of both living and museum specimens.

As far as can be practically done the positions of those in control of these are men of scientific knowledge in the various subdivisions of Zoology as well as that to which they have been specially attracted and this is as it should be, but unfortunately it is not always found to be the case in actual practice.

It should be the aim of those directing the work in all such collections and in museums especially, to see that one who is possessed of special knowledge of each department, should be the one appointed to fill each position. Speaking as an ornithologist and taking as an instance our own Australian Museum, I should like to see the staff appointment of a competent authority on birds. One who could devote all his time to this branch alone. The Australian Museum is acknowledged to be in possession of one of the finest collections of Australian birds, and as such, is entitled to have a specialist in ornithology whose duties would demand all his time.

Museums generally, possess these special workers, but in those cases where the duties are often divided between two or even more branches it is the duty of those in administrative control to see that such a state of things in these days of specialist work does not exist.

Personally, I am of opinion that the possession of a Science degree should not be a compulsory qualification, but I think also that although the holder of such position may know more of his special work than others he should be obliged during his tenure, to attend the Science Course at the University, even without sitting for the examination for a degree, if he has not already done so.

I think this should be the case in all branches of Zoology and thus the elucidation and determining of all new or doubtful species would be made easier and more free from error, and I urge those in authority to consider seriously this suggestion.

ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES.

BALANCE SHEET AT 30TH JUNE, 1921.

| LIABILITIES. | | ASSETS. | |
|---|-----------------|---|---------------|
| | £. s. d. | | £. s. d. |
| Capital | 445 5 0 | Investments in Government Securities | 445 5 0 |
| Handbook Fund | 196 3 7 | Govt. Savings Bank (Handbook Account) | .. 196 3 7 |
| Income Account at 30th June, 1921 | 118 14 11 | Cash in Bank | £9 17 9 |
| | | Cash in Savings Bank | £108 17 2 |
| | | | 118 14 11 |
| | £760 3 6 | | £760 3 6 |

RECEIPTS AND EXPENDITURE FOR YEAR ENDED 30TH JUNE, 1921.

| RECEIPTS. | | EXPENDITURE. | |
|--|----------------|--|------------|
| | £. s. d. | | £. s. d. |
| Balance from 30th June, 1920 | 81 19 2 | Publication—"Australian Zoologist"— | |
| Subscriptions | 273 15 9 | Printing | £148 13 11 |
| Sales | 5 3 6 | Blocks | 47 9 5 |
| Interest | 27 3 10 | Petty Cash and Expenses | 196 3 4 |
| Government Grant | 50 0 0 | Appropriation to Capital Account | 23 4 0 |
| | | Balance to 1st July, 1921 | 100 0 0 |
| | £438 2 3 | | 118 14 11 |
| | | | £438 2 3 |

HANDBOOK FUND ACCOUNT FOR YEAR ENDED 30TH JUNE, 1921.

| RECEIPTS. | | EXPENDITURE. | |
|--|----------------|--|----------|
| | £. s. d. | | £. s. d. |
| Balance from 30th June, 1920 | £268 5 8 | Printing Plates—Handbook of Fishes | 82 0 0 |
| Donations | 1 1 0 | Balance to 1st July, 1921 | 196 3 7 |
| Interest | 8 16 11 | | |
| | £278 3 7 | | £278 3 7 |

Sydney, 18th July, 1921.

G. A. WATERHOUSE, Hon. Treasurer.

We have examined the books and vouchers of the Society for the twelve months ended 30th June, 1921, and certify the above statement of Receipts and Disbursements and Balance Sheet to be in accordance therewith.

L. S. DRUMMOND & CO., Incorporated Accountants.

At a meeting of Council, held at the conclusion of the Annual General Meeting, the following officers for the year 1921-2 were elected:—

President:—J. H. Campbell, M.B.E.

Vice-Presidents: Dr. D'Ombain, H. E. Finckh, W. W. Froggatt and G. A. Waterhouse.

Hon. Secretary: A. F. Basset Hull.

Hon. Treasurer: G. A. Waterhouse.

Assistant Hon. Treasurer: D. G. Stewart.

Hon. Librarian: H. E. Finckh.

Hon. Editor: Launcelot Harrison.

NEWS AND NOTES.

New Members:—The following members have been elected since the publication of Part 2:—

Ordinary Members:—G. C. Addison, F. B. Anderson, J. T. Atteridge, S. E. Bradford, E. J. Bagley, W. R. Blow, A. N. Burns, W. C. Cormack, Miss V. Cormack, W. S. Capper, L. A. Curtis, L. H. Dickeson, T. Dunbabin, D. F. Evans, Miss Eiper, A. E. Eccles, Dr. A. E. Finckh, T. Felstead, T. H. Felstead, W. H. Felstead, Miss Glasgow, H. Gordon, R. W. Hooke, P. A. Haege, J. M. Hardie, A. T. Hogbin, A. A. Lawson, E. G. Lowe, R. V. Minnett, W. Newbery, A. J. Nicholson, G. Oswald, J. R. Patrick, J. Fowell, E. F. Pollock, Sir Arthur Rickard, E. S. Ranson, F. L. Rolin, J. D. Rae, S. J. Rayment, D. G. Stewart, W. H. Simpson, C. R. Strange, F. Townsend, N. Townsend, J. N. Weymark, A. D. Walker, A. Yarnold, Rev. A. H. Yarnold.

Associate Members:—L. Bloxsome, H. J. Carter, K. Cornford, Sir Edgeworth David, W. S. Dun, Dr. E. A. Fraser, J. J. Fletcher, Dr. A. S. Johnson, B.Sc., J. Foote, A. H. E. Mattingley, L. Moss-Robinson, Mrs. S. P. Norton, E. Spencer, C. Horton Smith, B.Sc., F. E. Wilson, Sir Charles Wade, H. Wolstenholme, and Capt. S. A. White.

Society's Registered Office:—Arrangements have been made under which the Society has the use of Room No. 10, First Floor, Bull's Chambers, Martin Place, jointly with Mr. G. J. Waterhouse. This is now the registered office of the Society under the Companies Act, 1899, and is available for holding meetings and for the convenience of members desiring to have access to the Library.

General Meeting:—An inaugural General Meeting of the Society was held at the office on Thursday, 29th September, 1921, at 7.30 p.m. There was a fair attendance of members. The President outlined the objects of the meeting, and referred to the advantages to accrue to the members, and particularly students who are specialising in any faunal group, from the possession of a room in which regular meetings can be held. A series of Resolutions carried by the meeting fixed the second Wednesday in the months of March, May, July, September, and November in each year, at 7.30 p.m. for holding Regular Meetings. The first of such meetings was held on Wednesday, 9th November, at 7.30 p.m. Mr. Hedley opened a discussion on "The Distribution of Animals in Australia." *Members will please accept this as the only notification of the meetings.* The labour of addressing circulars to a large number of members who do not attend, and the cost of postage, render it undesirable to notify each member separately of the date of each meeting.

Sections:—At the General Meeting it was also decided to form sections for the study of special Branches of Zoology. An Entomological Section has been established, Mr. G. M. Goldfinch acting as Honorary Secretary. Members wishing to join this Section will please communicate with Mr. Goldfinch, ad-

dress Box 2399, G.P.O., Sydney. The formation of Sections is in progress in regard to:—Ornithology, Zoological Photography, Marine Fauna. Further particulars will be published in the next issue of the "Australian Zoologist." In the meantime members desiring to join any of these Sections, or to form Sections in other subjects will please communicate with the Hon. Secretary of the Society.

Section Rules:—Under the powers conferred by Article 40, the Council have made the following Rules governing the establishment of Sections:—

Rule 4.*

- (a) Sections shall consist of not less than three members, one of whom shall act as Chairman and one as Honorary Secretary.
- (b) Meetings of Sections may be held in the Society's office on such dates as may be fixed by the Chairman and Secretary, in consultation with the Executive Officers of the Society.
- (c) Notices and reports of proceedings of Sections may be published in the "Australian Zoologist" subject to the approval of the Publication Committee. All such notices and reports must be handed to the Honorary Secretary of the Society.
- (d) Postage on Sectional notices required to be sent by post will be defrayed by the Society, and the necessary stationery will be provided, but any other expenses incidental to the work of the Sections must be met by the members of such Sections.
- (e) During the month of June, Sections shall report to the Council on their operations for the current year.

Acting Honorary Secretary:—During the absence of Mr. Basset Hull, who is visiting Western Australia, Mr. D. G. Stewart has been appointed to act as Honorary Secretary.

Entomological Section.

The entomological section formed in connection with the Society holds its meetings in Bull's Chambers, 28 Martin Place, at 7.30 p.m., on the 2nd Wednesdays in February, April, June, August and October. Mr. G. A. Waterhouse is the Chairman of the Section, Dr. E. W. Ferguson Vice-chairman, and Mr. G. M. Goldfinch Honorary Secretary. A special meeting of the Section was held on Tuesday, November 15th.

*For Rules 1 to 3 inclusive (Finance matters) see Vol. I., Part 5, p. 100.

DESCRIPTIONS OF FOUR NEW SPECIES OF AUSTRALIAN
CADDIS-FLIES, (ORDER TRICHOPTERA).

By R. J. Tillyard, M.A., Sc.D. (Cantab.), D.Sc. (Sydney), C.M.Z.S., F.L.S.,
F.E.S., Entomologist and Chief of the Biological Department, Cawthron In-
stitute, Nelson, N.Z., formerly Linnean Macleay Fellow in Zoology.

(With one Plate and six Text-figures).

The study of the Caddis-flies or Trichoptera of Australia and Tasmania has been greatly neglected, the most recent contribution to our knowledge of them, by Dr. G. Ulmer (1916), listing only twenty-four species all told, of which one genus and six species are described as new. This is certainly only a small fraction of the total Caddis-fly Fauna actually existing, since I have, in my own collection, about fifty undescribed species, most of which have been gathered from comparatively very few localities. These insects being for the most part unattractive and lacking in bright colours, are seldom taken by the ordinary collector. The systematist, again, if he wishes to study and describe them, finds many difficulties in his path. Until he has arrived at a considerable knowledge of the Order, he will require to study *at least four specimens* of each species, two males and two females. Two of these should be dissected, and cleared mounts made of their wings, mouth-parts, antennae, legs and abdominal appendages. The other two should be set in the usual manner, in order to be made the types of a new species, if, as very frequently happens with Australian specimens, they prove to be undescribed.

It will not be necessary here to go into details of the scheme of the wing-venation, which has been fully set out by Ulmer (1907), in a most comprehensive part of the *Genera Insectorum*, and compared with that of related Orders by myself (1919). The venational notation used in this paper will be the amended notation as given in that work. The classification adopted for the Order will be that given by Ulmer in his work just mentioned. The short notation for the tibial spurs will be used as in Ulmer's work; i.e., "Spurs 2, 4, 4," indicates that the fore tibiae possess one pair of spurs, the middle and hind tibiae two pairs each; while an odd number indicates a terminal spur only (1), or else a terminal pair with a single one further from the apex of the tibia (3).

There remains the necessity for a short explanation of the difficult and very complicated anal appendages of the male. These are best dealt with from above downwards, as follows:—

(a) The tenth tergite, standing dorsally above the anus, is frequently of peculiar shape and sculpture, and may send out either one or two long slender processes, called by Ulmer *fishbone-like processes*, but which I propose to term *apoterga*. (Text-figs. 2, 3, *at*).

(b) On either side of these, latero-dorsally, there project from the ninth tergite the *preanal appendages*, also very variable in shape, sometimes long and slender. (Text-figs. 2, 3, *pa*).

(c) Situated between the tenth sternite above and the ninth sternite below, is a single unpaired median organ, the *penis*, at the tip of which opens the ejaculatory duct. This organ is usually directed obliquely downwards. (Text-figs. 2, 3, *pe*).

(d) Developed ventrally from the ninth sternite, there is a pair of *gonapophyses* (called by Ulmer *genital-faet*), which may be either two-segmented or simple; they are generally either stouter than the other appendages, or of a very distinct shape. (Text-figs. 2, 3, *go*).

(e) A pair of shorter lateral processes from the ninth sternite are sometimes developed, lying close outside the bases of the gonapophyses. (Text-figs. 2, 3, *lp*).

Excellent specific characters are afforded by these genitalia, and no description of a male caddis-fly can be said to be either sufficient or accurate unless these parts are clearly figured, and their differences from those of related species indicated.

The end of the abdomen in the female lacks the specific variation found in the males, but the development of the tenth tergite is often sufficiently peculiar to offer a good specific character, and should most certainly be availed of when describing a new species from females only. (See Text-figs. 4, 5).

The four new species described in this paper are four of the most beautiful Caddis-flies yet found in Australia. Two of them will be found figured in one of the coloured plates accompanying the article on "Insects" in the forthcoming Australian Encyclopaedia of Messrs. Angus and Robertson, Sydney.

Family POLYCENTROPIDAE.

Genus STENOPSYCHODES Ulmer, 1916.

Ulmer in Arkiv for Zoologi, Bd. 10, No. 13, p. 5, figs. 7-11.

Genotype: *St. mjobergi* Ulmer (op. cit., p. 8), described from two males taken on Bellenden Ker, N. Queensland. ♀ unknown.

This remarkable genus is only doubtfully placed by Ulmer in the family *Polycentropidae*, owing to the fact that the last segment of the maxillary palpi is not very clearly annulated, and also because it possesses characters indicating affinities in other directions. Ulmer considers that it comes nearest to *Pseudostenopsyche* Dohler, from Chile; but, as only the female of this genus is known, the comparison is by no means complete.

Three new species are here assigned to this genus, and in two of these the female is known. It is possible, therefore, to extend the generic definition given by Ulmer, so as to include the characters of both sexes.

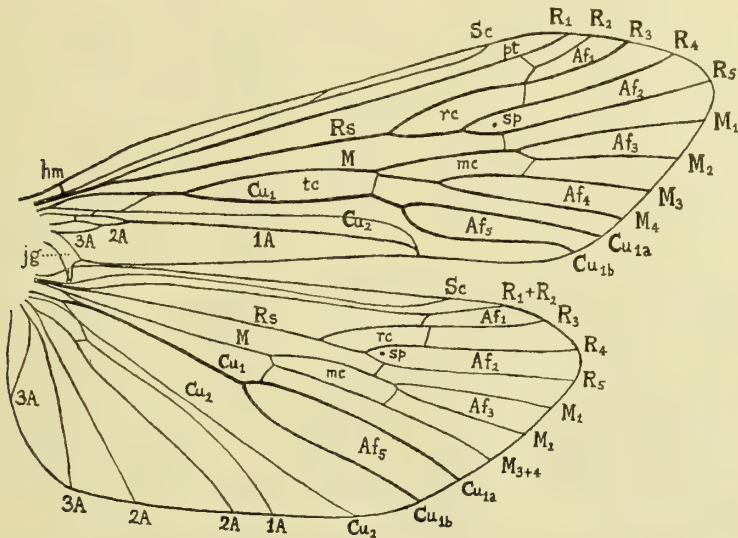
Head: *Ocelli* absent. *Eyes* prominent. In the male, the head is produced forward into a long *rostrum*, resembling that of *Plectrotarsus*; this is formed from the labrum and labium, the palpi of the latter being placed close up to the apex of the rostrum. In the female, these parts are not produced, and there is no definite rostrum. *Antennae* strongly built, longer than the forewings; their

basal segments set close together between, and a little in front of, the eyes, *Maxillary palpi* with two short basal segments; third segment long; the fourth about two-thirds as long as the third; fifth segment as long as the other four taken together, not very clearly annulated, but flexible and waved.

Thorax: *Legs* long and slender, the tarsi as long as the tibiae. Spurs 3, 4, 4; the subapical spurs of fore and middle tibiae placed at or a little before the middle, those of hind tibiae a little beyond the middle.

Abdomen: *Appendages* of male all strongly developed; the *apoterga* and the *preanal appendages* long and slender, the *penis* and *gonapophyses* stoutly built, and a pair of *lateral processes* from the ninth sternite lying close outside the latter. Female with the tenth tergite produced into a cornute process.

Wings: *Forewing* narrow at base, broader towards apex, which is rather narrowly rounded; a prominent jugal lobe projects from near the base transversely across the costal space of the hindwing. *Hindwing* broader, almost equally wide from base to end of Sc. *Wing-venation* complete and of primitive form, all the apical forks being present, and all the cells closed. Specialisations are, in the forewing, the bend of Cu₁ on leaving, *tc*, the distal arching of Cu₂ and the great shortening of 2A and 3A; in the hindwing, the great strength of Cu₁, the large size of its apical fork, the development of a wide anal area, and the forking of 2A and 3A near the base. The venational scheme is shown in Text-fig. 1.



Text-fig. 1: *Stenopsychodes hiemalis* n. sp., ♂. Wing-venation. 1A, 2A, 3A, the three anal veins; Af₁ to Af₅, the five apical forks (of which Af₄ is never present in hindwing); Cu₁, first cubitus, with its branches Cu_{1a}, Cu_{1b}; Cu₂, second cubitus or vena divdens; *hm*, humeral veinlet; *jg*, jugal lobe; *M*, media, with its four branches M₁ to M₄; *mc*, median cell; *pt*, pterostigma; R₁, main stem of radius; *Rs*, radial sector, with its four branches, R₂ to R₅; *rc*, radial or discoidal cell; *Se*, subcosta; *sp*, wing-spot; *tc*, thyridial cell.

Key to the Species.

1. Smaller species, expanding about one inch; third apical fork of forewing short, stalked 2.
- Larger species, expanding well over one inch; third apical fork of forewing either sessile on *mc*, or with *M*₁ and *M*₂ arising together from it 3.
2. In the male, the gonapophyses are much shorter than the preanal appendages, and have a strongly projecting interior tooth at one-third from apex *St. mjöbergi* Ulmer
- In the male, the gonapophyses and preanal appendages are of equal length, and the former have no projecting internal tooth.
St. montana n. sp.
3. Body black, forewings heavily marked with rich black and gold.
St. melanochrysa n. sp.
- Body yellowish brown, forewings fawn-coloured, with a delicate reticulation of pale fuscous *St. hiemalis* n. sp.

STENOPSYCHODES MONTANA n. sp.

(Plate XXIVA., fig. 1; Text-fig. 2).

♂. *Total length* 10.2, *forewing* 11, *hindwing* 9.5, *expanse* 24 mm.

Head black, with sparse golden hairs, a conspicuous patch of bright golden hairs between antennae. *Occiput* much swollen behind. *Antennae* (broken off) with basal segment black, somewhat swollen. *Eyes* greyish black. *Palpi* dull blackish.

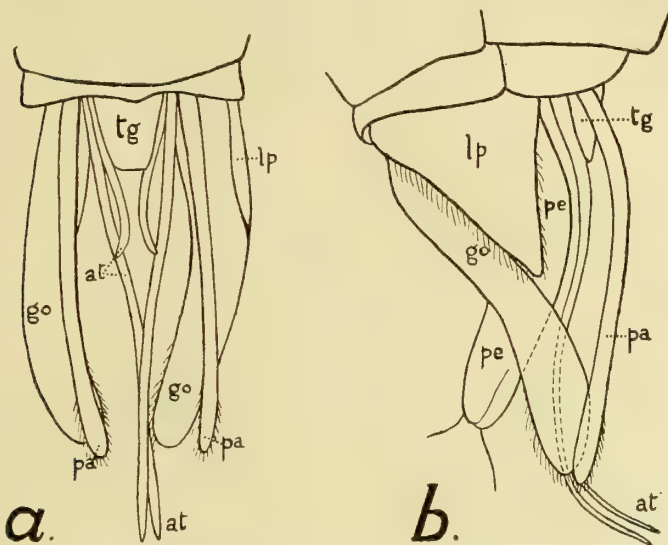
Thorax black with sparse golden hairs on *nota*. *Legs* dull blackish.

Abdomen slender cylindrical, black. *Appendages* rich brown, except basal two-thirds of gonapophyses, which are blackish. The ninth tergite is very short, the tenth narrow, produced to about two-fifths the length of the shorter pair of apoterga, and having a broadly truncated apex. Of the two pairs of apoterga, the shorter arise the closer together, converging until they almost meet close to their apices, then turning and diverging sharply; they are slender, sharply pointed, and somewhat less than half as long as the gonapophyses. The second pair of apoterga are excessively long and slender, about one-fourth as long again as the gonapophyses, converging from their bases to near half-way, when they run very close together and finally curve sharply upwards to their sharp apices beyond the gonapophyses. Preanal appendages of same length as gonapophyses, fairly slender and only slightly curved; their apical fourth slightly hairy, apex not sharply pointed. Penis broad, subcylindrical, somewhat shorter than gonapophyses, its apex notched, curving slightly downwards, and carrying a pair of titillatory bristles. Gonapophyses broad and strongly built, the basal half curving upwards, the apical half slightly inwards; the tips well rounded, slightly hairy. Closely appressed against and somewhat above the basal half of each is a broad, subtriangular process from the ninth sternite, carrying a series of short stiff hairs along the margin which borders the gonapophysis. These appendages are shown in dorsal view in Text-fig. 2, *a*, in lateral view in Text-fig. 2, *b*.

Wings: *Forewings* with all the veins outlined in black on a rich fulvous ground colour; distal border from beyond pterostigma around apex to tornus continuously margined with black, most deeply at apex itself. Numerous cross-bars of black connect all the veins, except in the basal half of the costal space,

thus giving the wing a closely reticulated appearance, as shown in Plate, fig. 1. *Hindwings* paler, semi-transparent fulvous, the distal border and cross-veins fuscous.

♀ unknown.



Text-fig. 2.: *Stenopsychodes montana* n. sp., ♂. Appendages, *a*, dorsal view; *b*, left lateral view. *at*, apoterga; *go*, gonapophyses; *lp*, lateral processes from ninth sternite; *pa*, preanal appendages; *pe*, penis (omitted from *a*); *tg*, tergite of tenth segment.

Habitat: Blue Mountains and Monaro Plateau, N.S.W.; mountains of Victoria and South Australia.

Type: Holotype ♂ (Katoomba, N.S.W., 3300 ft., Nov. 16th, 1912, R.J.T.) in Tillyard Collection, Cawthron Institute, Nelson, N.Z.

This species is fairly closely related to *St. mjöbergi* Ulm. from N. Queensland. *St. mjöbergi* has the preanal appendages half as long again as the gonapophyses, which are much more curved than in *St. montana*, and carry on their inner border, one-third from apex, a strongly projecting tooth, between which and the incurved apex there lies a deep bay. The penis of *St. mjöbergi* is much shorter than the gonapophyses, and apparently carries no titillators. There are other less important differences in the other appendages, as may be seen by consulting Ulmer's figures (1916, fig. 11).

STENOPSYCHODES HIEMALIS n. sp.

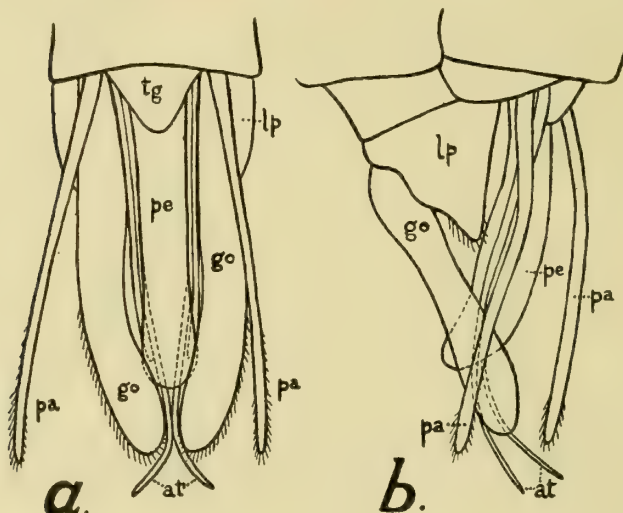
(Plate XXIV., fig. 2; Text-figs. 1, 3, 4).

♂. Total length 11.8, forewing 17, hindwing 13.2, expanse 35.5 mm.

Head, thorax and abdomen yellowish brown; antennae, legs and

appendages the same colour; eyes greyish black; occiput only slightly swollen behind. Length of hindleg 18 mm.

Wings: Forewings with a very close and delicate reticulation of pale fuscous on a ground colour of fawn, the costal margin and the space between the anal veins and posterior border less infuscated, and hence appearing paler and more definitely fawn-coloured than the rest. All the main veins medium fuscous, except R, which is much paler, and the anal veins, which are darker. Hindwings pale semi-transparent fawn-colour, the veins slightly darker.

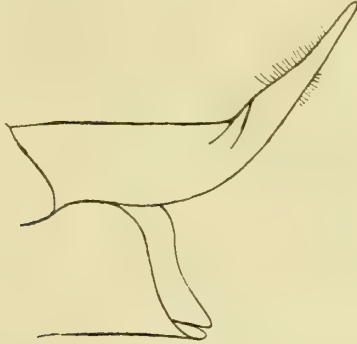


Text-fig. 3.: *Stenopsychodes hiemalis* n. sp., ♂. Appendages. a, dorsal view; b, left lateral view, slightly dorso-lateral. Lettering as in Text-fig. 2.

Appendages: These are on the same plan as in *St. montana*, but differ in the following points:—Tenth tergite not truncated apically; the longer pair of apoterga excessively slender, only slightly longer than the gonapophyses, beyond the ends of which their sharply pointed tips diverge widely upwards and outwards; the shorter pair very slender, nearly as long as the penis. Preanal appendages very slender, nearly straight, slightly hairy. Penis subcylindrical, the apex bent slightly downwards, apparently without titillators. The broad lateral processes from the ninth sternite are not so closely appressed to the gonapophyses, and their ventral border carries a definite bulge near the middle. These appendages are shown in dorsal view in Text-fig. 3, a, ventral view in Text-fig. 3, b.

♀. Closely resembling the male in size and markings, but darker. Antennae 20 mm. (those of the male are broken), dull reddish brown beneath, yellowish brown above. Thorax and abdomen rather dark brown. Forewing more deeply

infuscated than in male, but the space between anal veins and posterior border bright fawn-colour; above this, all the space between cubitus and anals is very darkly infuscated. *End of abdomen* with tenth tergite prolonged as shown in Text-fig. 4.



Text-fig. 4.: *Stenopsychodes hiemalis* n. sp., ♀. End of abdomen, left lateral view.

Habitat: Hornsby, N.S.W. Only found in August.

Types: Holotype male and Allotype female (Hornsby, Aug. 25th, 1917, R.J.T.) in Tillyard Collection, Cawthron Institute, Nelson, N.Z. Also a set of slides prepared from a third specimen (♂) taken on same date.

This fine species was discovered quite unexpectedly while searching for Stoneflies during the coldest part of the year. The first specimen was found resting on the inside of the black hollow trunk of a burnt eucalyptus tree near a creek in a precipitous gully. Sweeping the bushes overhanging the creek yielded two more specimens. The locality was visited and carefully searched afterwards at all seasons of the year, without any further specimens being taken. It is the only Caddis-fly known to me which is to be taken in August around Sydney.

STENOPSYCHODES MELANOCHRYSA n. sp.

(Text-figs. 5, 6).

♀ *Total length* 12, *forewing* 16.3, *expanse* 34 mm.

Head, thorax and abdomen jet black. *Antennae* (broken) with basal segment black. *Legs* dull blackish. *End of abdomen* produced into a dark brown, somewhat spoon-shaped process formed from the tenth tergite; ninth tergite carrying a fringe of long hairs. (Text-fig. 5).



Text-fig. 5.: *Stenopsychodes melanochrysta* n. sp., ♀. End of abdomen, left lateral view.

Wings: Forewing densely covered with short hairs; colour rich gold and black, arranged in a bold and irregular pattern, as shown in Text-fig. 6. Hind-wing black, with an irregular streak of gold along costa spreading downwards beyond half-way to form an irregular blotch of gold embracing the fork of Rs and nearly touching M.



Text-fig. 6.: *Stenopsychodes melanochrysta* n. sp., ♀. Forewing, to show pattern of black (shaded) and gold (left clear).

Habitat: Dorrigo, N.S.W. Two females only.

Types: Holotype ♀ (Dorrigo, W. Heron, undated) in Coll. South Australian Museum, Adelaide. Paratype ♀ in Cawthron Institute Collection, Nelson, N.Z. Both specimens are, unfortunately, much damaged.

Family HYDROPSYCHIDAE.

Genus *MACRONEMA* Pietet, 1836.

Two species of this widely distributed and handsome genus are known from Australia, viz.: *M. australe* McL. and *M. dubium* Ulmer. A third very strikingly beautiful species is here added.

MACRONEMA PULCHRIPENNE n. sp.

(Plate XXIVA., fig. 3).

♀. *Total length* 9, *forewing* 11, *expanse* 23.5 mm.

Head black, with sparse golden hairs on epieranium. *Antennae* slender, 18 mm. long, black. *Palpi* dark grey.

Thorax: Prothorax black, with two round golden spots on pronotum. *Meso* and *metathorax* black, the mesonotum with a large central patch of bright golden pubescence. *Legs* greyish brown; *tibial spurs* long.

Abdomen dull black throughout; in shape somewhat broad and flattened, narrowing towards apex; no prolongation of tenth tergite.

Wings: Smooth and shiny, without any conspicuous hairs, densely pigmented in gold and black, as shown in Plate XXIVA., fig. 3. *Forewing* black, marked with gold as follows: Base of wing gold, with an extension along costa to half-way, notched at about two thirds of its length by an intrusion of the black colour from below; another extension of the gold runs along basal third of posterior margin; pterostigma with a large subtriangular blotch of gold; a large irregular reniform blotch half-way along posterior border; another slightly smaller and more rounded blotch close to tornus. Near apex there are three smaller spots, the largest of which is near middle of termen, while two very much smaller ones lie above it near costa. Two or three very minute golden spots are scattered on the black portion of the wing at about one-third from base, and another very small one lies below the pterostigmatic blotch. *Hindwing* with basal two-thirds golden, the rest black, the costa with a narrow extension of the gold up to two-thirds of its length, where it swells out into a small semi-oval golden patch. The division between the gold and black across the wing very irregular.

Habitat: Stanwell Park, N.S.W. Three females, taken by Mr. G. Lyell, F.E.S., on April 24th, 1916.

Types: Holotype ♀ in Tillyard Collection, Cawthron Institute, Nelson, N.Z. Also a paratype ♀ in same collection and another in the Collection of the Museum of Comparative Zoology, Cambridge, Mass., U.S.A.

This and the preceding species are the two most brightly coloured of our Australian Caddis-flies. When flying slowly across a stream, they might be taken for one of the similarly coloured Australian Arctiid moths.

In concluding this paper, I desire to thank Mr. Nathan Banks, of the Museum of Comparative Zoology, Cambridge, Mass., for kindly examining the types of the species here described and confirming my determinations of them; also Mr. W. C. Davies, Curator of the Cawthron Institute, for the excellent photograph reproduced in Plate XXIVA.

EXPLANATION OF PLATE XXIVA.

Fig. 1. *Stenopsychodes montana* n. sp. ♂ (x 3).

Fig. 2. *Stenopsychodes hiemalis* n. sp. ♂ (x 3).

Fig. 3. *Macronema pulchripenne* n. sp. ♀ (x 3).

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- ULMER, G., 1907. Trichoptera, in Genera Insectorum, vol. ix., fasc. 60. P. Wytman, Tervueren, Belgium.
- ULMER, G., 1916. Results of Dr. E. Mjöberg's Expeditions to Australia, 1910-13. Trichoptera. Arkiv for Zoologi, Bd. 10, No. 13, pp. 1-23.

A NEW *RHYSSOPLAX*.

By A. F. Basset Hull.

When seeking material for a coloured plate of the different species of *Rhyssoplax* (*Chiton*), I experienced some difficulty in obtaining a specimen of *R. bednalli* Pilsbry, which is, perhaps, the rarest of the genus. The type shell is, I understand, in England. Dr. W. G. Torr, of Brighton, South Australia, kindly lent me one fine specimen, but learning that there was a better one in the Adelaide Museum, I applied to the Trustees for permission to examine it. On receipt of this shell I was surprised to find that it differed in such a degree from Dr. Torr's specimen as to constitute a distinct species. I then applied to the Trustees for permission to figure and describe the new shell, which was readily granted. The description and figures were forwarded to the Trustees for a decision as to publication, but were returned to me with an intimation that Messrs. Ashby, W. L. May and Dr. Torr, were of opinion that the shell was conspecific with *Rhyssoplax bednalli* Pilsbry.

I nevertheless publish the description, being of opinion that the shell shows sufficient variation from Pilsbry's shell to entitle it to recognition.

RHYSSOPLAX SURRECTA, n. sp. Plate XXIVB., Figs. 1-8.

Shell very long, narrow and elevated, carinated. Ground colour white, flecked with pale reddish-brown on the lateral areas and beaks of median valves; central areas washed with pale green, flecks of the same colour appearing on the jugal tract.

Anterior valve having twenty-six rows of more or less diamond-shaped pits, increasing in size and sometimes bifurcating towards the margin, the surface thus having the appearance of radiating riblets intersected by concentric lirae. The apex of the valve is thrown slightly forward. Valve half as long as the posterior valve.

Median valves beaked, lateral areas deeply furrowed, the furrow containing indications of additional grooves, in some cases one, and in others (notably valve ii) two, the number of additional grooves not corresponding on the opposite lateral areas of the same valves. The raised edges of the furrows are deeply corrugated, imparting a serrated appearance to the posterior margins of the valves. Central areas with eight to ten high ribs extending across the area, except as regards the two nearest the jugum, the ribs almost as wide as the interstices separating them.

Posterior valve with sculpture of radiating rows of pits, similar to those on the anterior valve, twenty-nine being indicated on the margin of the posterior area; eight ribs in the anterior area. Muero very prominent, behind the centre.

Girdle scales large, irregularly oval, striated, not highly polished.

Dimensions, 35 x 12 mm.; height 8 mm. The girdle of the type is very much contracted, and perhaps the width of a well-preserved specimen would be relatively greater.

Station; probably in deep water.

Type in the Adelaide Museum.

Mr. Edwin Ashby informs me that the history of this shell is that it was discovered by Mr. W. J. Kimber, of Adelaide, who was collecting many years ago at the end of a reef at Port Willunga at lowest tide. He noticed a *Chiton* floating foot upwards on the water, and upon securing the specimen he identified it as *R. bednalli* Pilsbry. The animal was in the shell, and was removed by Mr. Kimber. In colour this shell closely resembles Pilsbry's species, but it may be described as generally bolder, heavier and coarser in sculpture than *R. bednalli*, the figures in which the two shells are shown in detail expressing the differences more clearly than it is possible to convey in a verbal description.

Explanation of Plate XXIVB., Figs. 1-8.

1. *Rhyssoplax surrecta*, anterior valve.
2. " " one-half of a median valve.
3. " " posterior valve.
4. " " girdle scales.
5. *Rhyssoplax bednalli*, anterior valve.
6. " " one-half of a median valve.
7. " " posterior valve.
8. " " girdle scales.

CHECK LIST OF THE FISH AND FISH-LIKE ANIMALS OF
NEW SOUTH WALES.

Part iii

By Allan R. McCulloch, Zoologist, Australian Museum.

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XCIX.

Family MULLIDAE.

- A. Palate toothless; teeth of jaws in 1-2 rows. *Upeneus* (213).
AA. Vomer with, palatines with or without teeth.
B. Palatines with teeth. *Upeneoides* (214).
BB. Palatines toothless. *Upeneichthys* (215).

213. UPENEUS Cuvier, Reg. Anim. (2 ed.) ii., 1829, p. 157 (*bifasciatus*).

213a. U. SIGNATUS. SPOTTED RED MULLET. *Id.* Gunther, A.M.N.H. (3)
xx, 1867, p. 59. *Mullus signatus* Ogilby, Ed. Fish. N.S.W., 1893, p. 35,
pl. 11.

Though the young of this species are plentiful in Port Jackson, the adults are not often seen. Length 10 inches.

(A specimen recorded by Bleeker as *U. spilurus* Bleeker, from Port Jackson, Nederl. Tydschr. Dierk. ii, 1865, p. 71, is probably *U. signatus*).

214. UPENEOIDES Bleeker, Verh. Bat. Gen. xxii, 1849, p. 63 (*vittatus*).

214a. U. TRAGULA. *Upeneus tragula* Richardson, Ichth. China, 1845, p. 220.

Upeneoides tragula Day, Fish. India, 1875, p. 121, pl. 30, 4 (Pl. xxv).

Young specimens are captured by seine fishermen, but adults are rare in our waters. Length 9 inches.

215. UPENEICHTHYS Bleeker, Verh. Akad. Amsterdam ii, 1855, p. 7 (*porosus*).

215a. U. POROSUS. BLUE-STRIPED RED MULLET. *Upeneus porosus* Cuvier & Valenciennes, H. N. Poiss. iii, 1829, p. 455. *Upeneichthys porosus* Roughley, Fish. Austr., 1916, p. 139, pl. 44 (Pl. xxv).

A brilliantly coloured fish occurring around rocky headlands. Length 10 inches.

(*U. vlamingii* Cuv. & Val., has been recorded from Port Jackson by Castelnau, F.L.S. N.S.W. iii, 1879, p. 372. The record was evidently based upon a specimen of *U. porosus*).

C.

Family LETHRINIDAE.

A. Cheeks naked.

Lethrinus (216).

AA. Cheeks scaly.

Pentapus (217).216. LETHRINUS Cuvier, Reg. Anim. (2 ed.) ii, 1829, p. 184 (*choerorhynchus*).A. Second dorsal spine longer than those following it, more or less produced.
nematacanthus (216a).

AA. Second dorsal spine shorter than those following it.

B. 6 scales between first dorsal spine and lateral line.

opercularis (216b).

BB. 5 scales between first dorsal spine and lateral line.

chrysostomus (216c).216a. L. NEMATACANTHUS. *Id.* Bleeker, Verh. Bat. Gen. xxvi, 1856, p. 90,
and Atlas Ichth. viii, 1876, p. 114, pl. 337, 3.A tropical species occurring in southern Queensland, and once recorded from
New South Wales waters.216b. L. OPERCULARIS. *Id.* Cuvier & Valenciennes, H. N. Poiss. vi, 1830,
p. 289; *Id.* Bleeker, Atlas Ichth. viii, 1876, p. 119, pl. 335, 5 (Pl. xxv.).

Another tropical species rarely wandering southward into New South Wales.

216c. L. CHRYSOSTOMUS. ISLAND SNAPPER or YELLOW-MOUTHED SNAPPER.

Id. Richardson, Ichth. Erebus & Terror, 1848, p. 118, pl. 60, 6-7.

Occasionally captured in our northern waters, and reaching 3 feet in length.

(Castelnau, P.L.S. N.S.W. iii, 1879, p. 372, has recorded a species from
Port Jackson, which he doubtfully identified as *L. glyphodon* Gunther, while
Kner, Novara Zool. i, 1865, p. 81, equally doubtfully identified a fish as *L. harak*
Forskal, which was said to have been taken at Sydney. There is no reason to
suppose either species occurs in New South Wales).217. PENTAPUS Cuvier & Valenciennes, Hist. Nat. Poiss. vi, 1830, p. 258
(*vittatus*).217a. *P. setosus*. *Id.* Cuv. & Val., *Ibid.* p. 270. *Id.* Bleeker, Atlas.
Ichth. viii, 1876, p. 101, pl. 324, 1 (Pl. xxvi.).Another tropical fish ranging to southern Queensland, and once recorded
from New South Wales. Length 10 inches.

CI.

Family SPARIDAE.

A. Molars in 2 series; colour pinkish.

Pagrosomus (218).

AA. Molars in 3 or more series; colour olive-silver.

Sparus (219).218. PAGROSOMUS Gill, Mem. Acad. Sci. Wash. vi, 1893, p. 97 (*auratus*).218a. *P. auratus*. SNAPPER. *Labrus auratus* (Forster) Bloch & Schneider.
Syst. Ichth. 1801, p. 266. *P. auratus* Roughley, Fish. Austr., 1916, p.
130, pl. 42 and frontispiece (Pl. xxv).The choice fish of our market and commanding a higher price than any
other. The young stages are popularly known as Cocknies, which develop
through Red Bream and Squire into the adult form recognised as Snapper.
Large examples in which the nape is elevated into a huge bony boss and the
snout developed into a curious fleshy nose are known as Old-men Snapper;
these attain a weight of over 30 pounds.219. SPARUS Linn., Syst. Nat. 10th ed. i, 1758, p. 277 (*aurata*).

A. Anal with 7-9 rays; body without longitudinal stripes.

australis (219a).

AA. Anal with 11 rays; body with golden longitudinal stripes.

sarba (219b).

- 219a. S. AUSTRALIS. BLACK BREAM. *Chrysophrys australis* Gunther, B.M. Cat. Fish. i, 1859, p. 494; *Id.* McCoy, Prodr. Zool. Viet. dec. i, 1878, pl. 4 (Pl. xxv).

One of the most important of our food fishes, occurring in great quantities in the harbours and estuaries. Length 22 inches, weight 7½ pounds.

- 219b. S. SARBA. TARWHINE. *Id.* Forskal, Deser. Anim., 1775, p. 31. *Chrysophrys sarba* Stead, Ed. Fish. N.S. Wales, 1908, p. 78, pl. 47.

A northern fish, less plentiful than the preceding. Length 16 inches, weight 3½ pounds.

CII. Family KYPHOSIDAE.

220. KYPHOSUS Lacep., H. N. Poiss. iii, 1802, p. 114 (*bigibbus*).

- 220a. K. SYDNEYANUS. SILVER DRUMMER. *Pimelepterus sydneyanus* Gunther, A.M.N.H. (5) xviii, 1886, p. 368. *K. sydneyanus* McCulloch, Rec. Austr. Mus. xiii. 2, 1920, p. 56, pl. 12, 2 (Pl. xxv).

Abundant during the summer months, but not regarded as of much value as a food fish. Length 30 inches.

CIII. Family GIRELLIDAE.

A. Operculum largely naked; less than 60 scales in a longitudinal row. *Girella* (221).

AA. Operculum scaly; about 80 scales in a longitudinal row. *Melambaphes* (222).

221. GIRELLA Gray, Illustr. Ind. Zool., 1835, pl. 98 (*punctata*).

A. Outer teeth of jaws imbricate, in 2-4 rows. *tricuspidata* (221a).

AA. Outer teeth of jaws in single rows.

B. 14-16 dorsal spines; nostrils scarcely fimbriate. *cyanea* (221b).

BB. 13 dorsal spines; nostrils markedly fimbriate. *elevata* (221c).

- 221a. G. TRICUSPIDATA. BLACKFISH. *Boops tricuspidatus* Quoy & Gaimard, Voy. Uranie, 1824, p. 296. *G. tricuspidata* McCulloch, Rec. Austr. Mus. xiii. 2, 1920, p. 60, pl. 14, 1 (Pl. xxv).

One of the commonest fishes in the markets, being captured by net fishermen in inlets throughout the year, while it is also taken by line along the coast. Length 20 inches, weight 6 pounds.

- 221b. G. CYANEA. BLUEFISH. *Id.* Macleay, P.L.S. N.S.W. v, 1881, p. 409. *Id.* Waite, Rec. Austr. Mus. v. 3, 1904, p. 167, pl. 20, 3.

Not common on this coast but plentiful at Lord Howe Island, where it is regarded as a fine table fish. Length about 2 feet.

- 221c. G. ELEVATA. BLACK DRUMMER. *Id.* Macleay, P.L.S.N.S.W., v, 1881, p. 408; *Id.* McCulloch, Rec. Austr. Mus. xiii. 2, 1920, p. 64, pl. 13, 1.

Lives among weed-covered rocks along the coast, and occasionally congregates in schools. Length about 2 feet.

(*G. zonata* Gunther, has been included in a list of Port Jackson fishes by Castelnau, P.L.S.N.S.W. iii, 1879, p. 350, but the species has not since been recognised from New South Wales).

222. MELAMBAPHES Gunther, A.M.N.H. (3) vi, 1863, p. 115 (*nigroris* Gthr., not of Cuv. & Val.).

- 222a. *M. ZEBRA*. *Crenidens zebra* Richardson, Ichth. Erebus & Terror, 1846, p. 70. *Girella zebra* Steindachner, Sitzb. Akad. Wiss. Wien. liii, 1866, p. 430, pl. 6, 2 (Pl. xxv).

The specimen described and figured by Steindachner was said to have been taken in Port Jackson, but no other appears to have been recognised from New South Wales.

CIV.

Family PEMPHERIDAE.

A. Scales of the body ctenoid.

Pempheris (223).

AA. Scales of the body cycloid.

Liopempheris (224).

223. PEMPHERIS Cuvier, Reg. Anim. 2nd ed. ii, 1829, p. 195 (*touea* = *compressa*).

- 223a. *P. COMPRESSA*. BULLSEYE. *Sparus compressus* Shaw, White's Voy. N.S. Wales, 1790, p. 267, pl. 12. *P. compressus* Stead, Ed. Fish. N.S. Wales, 1908, p. 49, pl. 18 (Pl. xxvi).

A small species covered with rough scales. Length about 8 inches.

224. LIOPEMPHERIS Ogilby, Mem. Qld. Mus. ii, 1913, p. 62 (*multiradiata*).

A. 46-50 scales on lateral line to hypural joint.

multiradiata (224a).

AA. About 60 scales on lateral line to hypural joint.

affinis (224b).

- 224a. *L. MULTIRADIATA*. BIG-SCALED BULLSEYE. *Pempheris multiradiatus* Klunzinger, Sitzb. Akad. Wiss. Wien. lxxx. i, 1879, p. 381. *P. macrolepis* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 73, pl. 10.

Occurs in water of moderate depths where it is captured by the trawlers. Length about 8 inches.

- 224b. *L. AFFINIS*. *Pempheris affinis* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 45, pl. 7, 1 (Pl. xxvi).

A rare species less than 6 inches long.

CV.

Family MONODACTYLIDAE.

A. 8 dorsal spines, scales finely ctenoid.

Monodactylus (225).

AA. 5 dorsal spines; scales cycloid.

Schuettea (226).

225. MONODACTYLUS Lacep., H. N. Poiss. iii, 1802, p. 131 (*falciformis*).

- 225a. *M. ARGENTEUS*. SILVER BATFISH. *Chaetodon argenteus* Linn., Syst. Nat. 10th ed. i, 1758, p. 272. *Psettus argenteus* Richardson, Ichth. Erebus & Terror, 1846, p. 57, pl. 35, 1-3 (Pl. xxvi).

A widely distributed tropical fish which ranges southward to Sydney. Length 8 inches.

226. SCHUETTEA Steindachner, Sitzb. Akad. Wiss. Wien. liii. 1, 1866, p. 449 (*scalaripinnis*).

- 226a. *S. SCALARIPINNIS*. *Id.* Steindachner, *Ibid.*, pl. 6, *Id.* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 81, pl. 15 (Pl. xxvi).

Occasionally captured in nets on the coast near Sydney. Length 8 inches.

CVI.

Family SCORPIDIDAE.

A. Dorsal spines increasing in height backwards, lower than the anterior rays.

Scorpiis (227).

AA. Median dorsal spines longest, higher than the rays.

Atypichthys (228).

227. SCORPIS Cuv. & Val., H. N. Poiss. viii, 1831, p. 503 (*georgianus*).
 A. Anal rays equal to, or more numerous than those of dorsal. *lineolatus* (227a).
 AA. Anal rays less numerous than those of dorsal. *violaceus* (227b).
 227a. S. LINEOLATUS. SWEEP. *Id.* Kner, Novara Zool. i, Fische pt. 1, 1865, p. 108, pl. 5, 3 (Pl. xxvi).
 Young specimens are very plentiful in inlets, while adults are more commonly captured along the coast. Length 12 inches.
 227b. S. VIOLACEUS. HARD-BELLY. *Ditrema violacea* Hutton, Trans. N.Z. Inst. v, 1873, p. 261, pl. 8, 31b.
 Abundant at Lord Howe Island, and once recorded from near Sydney. The record needs verification. Length 9 inches.
 228. ATYPICHTHYS Gunther, B.M. Cat. Fish. iv, 1862, p. 510 (*strigatus*).
 228a. A. STRIGATUS. MADO. *Atypus strigatus* Gunther, B.M. Cat. Fish. ii, 1860, p. 64. *Id.* Steindachner, Sitzb. Akad. Wiss. Wien liii, 1866, p. 435, pl. 4, 2 (Pl. xxvi).
 Plentiful in inlets along the coast. Length 10 inches.

CVII.

Family SCATOPHAGIDAE.

229. SCATOPHAGUS Cuvier & Valenciennes, H. N. Poiss. vii, p. 136 (*argus*).
 A. Margins of dorsal and anal fins subvertical; sides spotted above and below. *argus* (229a).
 AA. Margins of dorsal and anal fins extending obliquely forward; sides striped above, spotted below. *multifasciatus* (229b).
 229a. S. ARGUS. SPOTTED BUTTERFISH. *Chaetodon argus* Linne, Syst. Nat. 12th ed., 1766, p. 464. *S. argus* Day, Fish. India, 1875, p. 114, pl. 29, 3.
 A tropical species, rare in our waters. Length 12 inches.
 229b. S. MULTIFASCIATUS. BUTTERFISH. *Id.* Richardson, Ichth. Erebus & Terror, 1846, p. 57, pl. 35, 4-6 (Pl. xxvi).
 Plentiful in estuaries of the northern rivers. Length 16 inches.

CVIII.

Family PLATACIDAE.

230. PLATAX Cuvier, R. Anim. ii, 1817, p. 334 (*teira*).
 230a. P. TEIRA. BAT FISH. *Chaetodon teira* Forskal, Descr. Anim., 1775, p. 60; *Id.* Bleeker, Atlas Ichth. ix, 1877-8, p. 73, pls. 279, 2 and 382, 1 (Pl. xxvii).
 Another tropical species wandering southward into our northern waters. Length 20 inches.

CIX.

Family CHAETODONTIDAE.

- A. Dorsal spines not increasing in height backward.
 B. Snout produced into a slender beak; 9 dorsal spines. *Chelmon* (231).
 BB. Snout shorter, not beak-like; more than 9 dorsal spines.
 C. Fourth dorsal spine greatly produced and filiform. *Heniochus* (232).
 CC. No elongate spine, the margin of the spines rounded.
 D. Scales minute, more than 70. *Vinculum* (233).
 DD. Scales larger, 35-60.
 E. Second anal spine longer than third. *Microcanthus* (234).
 EE. Second anal spine not longer than third. *Chaetodon* (235).
 AA. Dorsal spines increasing in height backward.
 F. Eleven dorsal spines. *Chelmonops* (236).
 FF. Six to seven dorsal spines. *Parachaetodon* (237).

231. CHELMON Cuvier, R. Anim. ii, 1817, p. 334 (*rostratus*).

231a. C. ROSTRATUS. BEAKED CORAL-FISH. *Chaetodon rostratus* Linne, Syst. Nat. 10th ed., 1758, p. 273. *Chelmo rostratus* Day, Fish. India, 1875, p. 110, pl. 28, 2 (Pl. xxvii).

Frequents coral regions. A single specimen is in the Australian Museum from Iluka, Clarence River. Length about 5 inches.

232. HENIOCHUS Cuvier, R. Anim. ii, 1817, p. 335 (*macrolepidotus*).

232a. H. ACUMINATUS. PENNANT CORAL-FISH. *Chaetodon acuminatus* Linne, Syst. Nat. 10th ed., 1758, p. 272. *H. macrolepidotus* Day, Fish. India, 1875, p. 110, pl. 28, 3 (Pl. xxvii).

Another species of coral regions, occasionally reaching the northern waters of the State. Length 18 inches.

233. VINCULUM McCulloch, Biol. Res. Endeavour ii. 3, 1914, p. 110 (*sexfasciatum*).

233a. V. SEXFASCIATUM. *Chaetodon sexfasciatus* Richardson, A.M.N.H. x, 1842, p. 26. *V. sexfasciatum* McCulloch, Biol. Res. Endeavour ii. 3, 1914, p. 110, pl. 22 (Pl. xxvii).

A southern fish, unreliably recorded from New South Wales. Length 10 inches.

234. MICROCANTHUS Swainson, Nat. Hist. Fish. Amphib. Rept. ii, 1839, p. 215 (*strigatus*).

234a. M. STRIGATUS. STRIPEY. *Chaetodon strigatus* Cuv. & Val., H. N. Poiss. vii, 1831, p. 25, pl. 170 (Pl. xxvii).

Plentiful in estuaries along the coast. Length about 6 inches.

235. CHAETODON Linne, Syst. Nat. 10th ed., 1758, p. 272 (*capistratus*).

A. A blackish band extends around bases of dorsal and anal fins, crossing the peduncle; body dark. *flavirostris* (235a).

AA. No such dark band; body light.

B. A dark ocellus on the dorsal fin; one dorsal ray produced. *setifer* (235b).

BB. No ocellus on the dorsal fin and no produced ray. *citrinellus* (235c).

235a. C. FLAVIROSTRIS. CORAL-FISH. *Id.* Gunther, Fische Sudsee i, 1874, p. 41, pl. 32, a.

A specimen 6 inches long, forwarded by the Department of Fisheries to the Australian Museum, is the first of the species to be recognised from New South Wales: It is from Iluka, Clarence River.

235b. C. SETIFER. HAIR-FINNED CORAL-FISH. *Id.* Bloch, Ausl. Fische ix, 1795, p. 101, pl. 426, 1.

A widely distributed and ornate species which occasionally wanders southward into our northern waters. A specimen is in the Australian Museum from Iluka, Clarence River. Length 7 inches.

235c. C. CITRINELLUS. CORAL-FISH. *Id.* Cuv. & Val., H. N. Poiss. vii, 1831, p. 27; *Id.* Valenciennes, R. Anim. Illustr. Poiss., 1843, pl. 39, 1 (Pl. xxvii).

A small tropical species occasionally extending into our waters.

236. CHELMONOPS Bleeker, Arch. Neerl. Sc. Nat. xi, 1876, p. 304 (*truncatus*).

236a. C. TRUNCATUS. *Chaetodon truncatus* Kner, Sitzb. Akad. Wiss. Wien. xxxiv, 1859, p. 442, pl. 2 (Pl. xxvii).

A fairly common species, attaining a length of 8 inches.

237. *PARACHAETODON* Bleeker, Versl. Akad. Amsterdam (2) viii, 1874, p. 371 (*oligacanthus*).

237a. *P. OCELLATUS*. *Platax ocellatus* Cuv. & Val., H. N. Poiss. vii, 1831, p. 229. *Parachaetodon ocellatus* Bleeker, Atlas Ichth. ix, 1877, p. 24, pl. 377, 4 (Pl. xxvii).

An occasional wanderer into New South Wales waters.

CX. Family ENOPLOSIDAE.

238. *ENOPLOSUS* Lacep., H. N. Poiss. iv, 1802, p. 540 (*armatus*).

238a. *E. ARMATUS*. OLD WIFE. *Chaetodon armatus* Shaw, White's Voy. N.S. Wales, 1790, p. 284, pl. —, 1. *Enoplosus armatus* Stead, Ed. Fish. N.S. Wales, 1908, p. 62, pl. 32 (Pl. xxviii).

A very common fish in harbours and estuaries. Length about 9 inches.

CXI. Family HISTIOPTERIDAE.

- A. Base of spinous dorsal shorter than that of the soft portion.

B. Posterior dorsal spines not longer than the median ones; 2 anal spines. *Paristiopterus* (239).

BB. Posterior dorsal spines longest; 3 anal spines. *Zanclistius* (340).

- AA. Base of spinous dorsal longer than that of the soft portion. *Pentaceropsis* (241).

239. *PARISTIOPTERUS* Bleeker, Arch. Neerl. Sci. Nat. xi, 1876, p. 268 (*insignis*).

239a. *P. LABIOSUS*. GIANT BOAR-FISH. *Histiopterus labiosus* Gunther, P.Z.S. 1871, p. 658, pl. 59. *H. farnelli* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 116, pl. 27 (Pl. xxviii).

A fine edible fish, reaching a length of 2 feet.

240. *ZANCLISTIUS* Jordan, P.U.S. Nat. Mus. xxxii, 1907, p. 236 (*elevatus*).

240a. *Z. ELEVATUS*. SPOTTED BOAR-FISH. *Histiopterus elevatus* Ramsay & Ogilby, P.L.S. N.S.W. (2) iii, 1888, p. 1311; *Id.* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 114, pl. 26 (Pl. xxviii).

A common species in deep water, where it is taken by the trawlers. Length 12 inches.

241. *PENTACEROPSIS* Steindachner, Denk. Akad. Wiss. Wien xlviii, 1883, p. 13 (*recurvirostris*).

241a. *P. RECURVIROSTRIS*. LONG-SNOURED BOAR-FISH. *Histiopterus recurvirostris* Richardson, Ichth. Erebus & Terror, 1845, p. 34. *Prosoplismus recurvirostris* Waite, Rec. Austr. Mus. v, 1903, p. 58, pl. 6 (Pl. xxviii).

A southern species, growing to about 20 inches long.

CXII. Family CEPOLIDAE.

242. *CEPOLA* Linne, Syst. Nat. 12th ed., 1766, p. 445 (*taenia*).

242a. *C. AUSTRALIS*. BAND-FISH. *Id.* Ogilby, P.L.S. N.S.W. xxiv, 1899, p. 185; *Id.* McCulloch, Biol. Res. Endeavour ii. 3, 1914, p. 109, pl. 34, 1 (Pl. xxviii).

A rare species, pink in colour, and growing to 10 inches long.

CIRRHITIFORMES.

Percoid fishes which usually have some of the lower pectoral rays simple and thickened.

- A. 10 dorsal spines. Fam. *Cirrhitidae* (cxiii).
 AA. 14-22 dorsal spines.
 B. Teeth compressed, tricuspid or lanceolate. Fam. *Aplodactylidae* (cxiv).
 BB. Teeth conical, acute.
 C. Scales small, about 100; 36 or more dorsal rays. Fam. *Latrididae* (cxvii).
 CC. Scales larger; less than 36 dorsal rays.
 D. Vomer toothless. Fam. *Cheilodactylidae* (cxvi).
 DD. Vomer with teeth. Fam. *Chironemidae* (cxv).

CXIII.

Family CIRRHITIDAE.

243. CIRRHITICHTHYS Bleeker, Nat. Tijd. Nederl. Ind. x, 1856, p. 474 (*graphidopterus*).

- 243a. C. APRINUS. *Cirrhitites aprinus* Cuv. & Val., H. N. Poiss. iii, 1829, p. 76. *Cirrhitichthys aprinus* Bleeker, Atlas. Ichth. viii, 1877, p. 146, pl. 303, 1 (Pl. xxix).

A single specimen taken in Port Jackson was only a straggler from the tropics. Length 5 inches.

CXIV.

Family APLODACTYLIDAE.

244. CRINODUS Gill, P. Acad. N. Sci. Philad. 1862, p. 110 (*lophodon*).

- 244a. C. LOPHODON. ROCK CALE. *Haplodactylus lophodon* Gunther, B.M. Cat. Fish. i, 1859, p. 435. *H. obscurus* Castelnau, F.L.S. N.S.W. iii, 1879, p. 374.

Plentiful around rocky reefs in deep water. Length 18 inches.

CXV.

Family CHIRONEMIDAE.

245. CHIRONEMUS Cuv. & Val., H. N. Poiss. iii, 1829, p. 78 (*georgianus*).

- 245a. C. MARMORATUS. KELP FISH. *Id.* Gunther, B.M. Cat. Fish. ii, 1860, p. 76; *Id.* Ogilby, Ed. Fish. N.S. Wales, 1893, p. 54, pl. 17 (Pl. xxix).

Plentiful among weed covered rocks along the coast. Length 14 inches.

CXVI.

Family CHEILODACTYLIDAE.

- A. Anal fin almost oblong, with 12 or more rays. *Dactylopagrus* (246).
 AA. Anal fin with less than 12 rays, the anterior much higher than the posterior.
 B. Cheeks naked. *Dactylophora* (247).
 BB. Cheeks scaly. *Cheilodactylus* (248).
 246. DACTYLOPAGRUS Gill, P. Ac. N. Sci. Philad. 1862, p. 114 (*carponemus*).
 A. A dark nuchal band from the back to the shoulder. *macropterus* (246a).
 AA. No such dark band. *morwong* (246b).

- 246a. D. MACROPTERUS. JACKASS-FISH. *Cichla macroptera* Bloch & Schneider, Syst. Ichth., 1801, p. 342. *Dactylosparus macropterus* McCulloch, Biol. Res. Endeavour i. 1, 1911, p. 66, pl. 12 (Pl. xxix).

A southern fish, abundant in deep water. Length 2 feet.

- 246b. D. MORWONG. MORWONG. *Chilodactylus morwong* Ramsay & Ogilby, P.L.S. N.S.W. (2) i, 1886, p. 879. *C. carponemus* Ogilby, Ed. Fish. N.S.W., 1893, p. 55, pl. 18—not *C. carponemus* Cuv. & Val.

Commonly confused with the preceding species. Length about 2 feet.

247. DACTYLOPHORA De Vis, P.L.S. N.S.W. viii, 1883, p. 284 (*semimaculata*).

247a. D. NIGRICANS. DUSKY MORWONG. *Chilodactylus nigricans* Richardson, P.Z.S. 1850, p. 63. *C. nebulosus* Steindachner, Sitzb. Akad. Wiss. Wien lxxxviii. 1, 1884, p. 1078, pl. 2.1 (Pl. xxix).

A southern fish, growing to about 2 feet long.

248. CHEILODACTYLUS Lacep., H. N. Poiss. v, 1803, p. 5 (*fasciatus*).

- | | |
|---|------------------------------|
| A. Margin of spinous dorsal evenly convex. | subg <i>Cheilodactylus</i> . |
| B. 31-33 dorsal rays; body nearly uniform. | <i>fuscus</i> (248a). |
| BB. 26-27 dorsal rays; body with brown cross bands. | <i>spectabilis</i> (248b). |
| AA. Spinous dorsal elevated in front. | subg. <i>Goniistius</i> . |
| C. Body white, with oblique blackish bands. | <i>gibbosus</i> (248c). |

248a. C. FUSCUS. RED MORWONG. *Id.* Castelnau, P.L.S. N.S.W. iii, 1879, p. 376; *Id.* Roughley, Fish. Austr., 1916, p. 125, pl. 40 (Pl. xxix).

A fine food fish, common around sunken reefs. Length 15 inches.

248b. C. SPECTABILIS. BROWN-BANDED MORWONG. *Id.* Hutton, Fish. N. Zealand, 1872, p. 8, and T. N. Zeal. Inst. v, 1873, p. 259, pl. 7, 11.

A southern fish, not common in New South Wales. Length about 2 feet.

248c. C. GONIISTIUS GIBBOSUS. MAGPIE MORWONG. *Chilodactylus gibbosus* Richardson, P.Z.S. 1841, p. 21. *Goniistius gibbosus* Stead, Ed. Fish. N.S. Wales, 1908, p. 72, pl. 41 (Pl. xxix).

Not uncommon in inlets along the coast, but not often captured by line fishermen. Length 12 inches.

CXVII.

Family LATRIDIDAE.

- | | |
|--|---------------------------|
| A. Vomer with teeth; median pectoral rays longest. | <i>Latris</i> (249). |
| AA. Vomer toothless; upper pectoral rays longest. | <i>Latridopsis</i> (250). |

249. LATRIS Richardson, P.Z.S. 1839, p. 99 (*hecateia*).

249a. L. LINEATA. TASMANIAN TRUMPETER. *Cichla lineata* Bloch & Schneider, Syst. Ichth., 1801, p. 342. *Latris hecateia* Richardson, Tr. Zool. Soc. iii, 1842, p. 106, pl. 6, 1 (Pl. xxix).

Said to occur in the southern waters of New South Wales, but not reliably recorded. Length about 40 inches.

250. LATRIDOPSIS Gill, P. Acad. N. Sci. Philad. 1862, p. 114 (*ciliaris*).

250a. L. FORSTERI. BASTARD TRUMPETER. *Latris forsteri* Castelnau, P. Zool. Soc. Viet. i, 1872, p. 77. *Latridopsis forsteri* McCulloch, Biol. Res. Endeavour iii. 3, 1915, p. 146, pl. 27 (Pl. xxix).

A southern fish, occurring in deeper water in New South Wales. Length about 2 feet.

POMACENTRIFORMES.

CXVIII.

Family POMACENTRIDAE.

Small ornate fishes, plentiful in tropical waters, which have but a single nostril on each side of the snout. The lower pharyngeals are ankylosed to form a single bone.

- A. Teeth usually compressed, sometimes subcylindrical.
 B. Posterior edge of preoperculum serrated.
 C. Spinous dorsal fin scaly like the soft portion. *Pomacentrus* (251).
 CC. Spinous dorsal fin naked. *Daya* (252).
 BB. Posterior edge of preoperculum smooth.
 D. 30 or less scales in a longitudinal row. *Glyphisodon* (253).
 DD. More than 30 scales in a longitudinal row. *Farma* (254).
 AA. Teeth conical. *Chromis* (255).

251. POMACENTRUS Lacep., H. N. Poiss. iv, 1803, p. 505 (*pavo*).

251a. P. UNIFASCIATUS. *Id.* Steindachner, Sitzb. Akad. Wiss. Wien. lvi. 1, 1867, p. 326.

A little known species which has not been recognised since first described. Length $7\frac{1}{2}$ inches.

252. DAYA Bleeker, Verh. Holl. Mij. Haarlem, 1877, p. 71 (*jerdoni*).

252a. D. JERDONI. *Pomacentrus jerdoni* Day, F.Z.S. 1873, p. 237, and Fish. India, 1877, p. 383, pl. 80, 7. *P. dolii* Macleay, P.L.S. N.S.W. vi, 1881, p. 65, pl. i, l.

The types of *P. dolii* in the Macleay Museum, prove to be similar in all details to specimens from Queensland which I identify as *D. jerdoni*. They were doubtless stragglers from the northern waters. Length $4\frac{1}{2}$ inches.

253. GLYPHISODON Lacep., H. N. Poiss. iv, 1803, p. 542 (*moucharra*).

- A. Teeth strongly compressed; colouration not uniform.
 B. Body light, with 5 darker cross bands. *saxatilis* (253a).
 BB. Body dark, with 1 light cross band; a dark ocellus on the dorsal fin. *leucozona* (253b).
 AA. Teeth subcylindrical; body uniformly coloured. *immaculatus* (253c).

253a. G. SAXATILIS. BANDED DEMOISELLE. *Chaetodon saxatilis* Linne, Syst. Nat. 10th ed., 1758, p. 276. *Glyphidodon coelestinus* Bleeker, Atlas Ichth. ix, 1877, pl. 408, 5 (Pl. xxviii).

A common tropical species, which sometimes extends southward to Sydney. Length 6 inches.

253b. G. LEUCOZONA. *Id.* Bleeker, Nat. Tijd. Ned. Ind. xix, 1859, p. 338, and Atlas Ichth. ix, 1877, pl. 407, 2.

A small species, only once taken near Sydney.

253c. G. IMMACULATUS. BLUE PULLER. *Heliastes immaculatus* Ogilby, P.L.S. N.S.W. x, 1886, p. 446; *Id.* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 86, pl. 14 (Pl. xxviii).

This species is apparently better associated with the genus *Glyphisodon* than with *Heliastes*, though its teeth are less compressed than is usual in the former genus. Length 6 inches.

(Two small specimens recorded as *G. uniocellatus* Quoy & Gaimard, from Sydney, by Steindachner, Sitzb. Akad. Wiss. Wien. lvi. 1, 1867, p. 328, were doubtless incorrectly identified).

254. FARMA Gunther, Brit. Mus. Cat. Fish. iv, 1862, p. 57 (*microlepis*).

254a. P. MICROLEPIS. WHITE-EAR. *Id.* Gunther, *Loc. cit.*, p. 58. *Hypsypops microlepis* Waite, Rec. Austr. Mus. vi. 2, 1905, p. 67, pl. 12, 1-3 (Pl. xxviii).

Common among rocks. The young are orange with broad blue bands above, but the adults are black with a white patch on the gill-covers. Length 7 inches.

255. CHROMIS Cuvier, Mem. Mus. Hist. Nat. Paris i, 1815, p. 353 (*chromis*).
 255a. C. HYPSSILEPIS. BROWN PULLER. *Heliastes hypsilepis* Gunther.
 A.M.N.H. (3) xx, 1867, p. 66. *Chromis hypsilepis* McCulloch, Zool.
 Res. Endeavour i. l, 1911, p. 73, pl. 14 (Pl. xxviii).
 Not uncommon around rocky places on the coast. Length 7½ inches.

DIVISION LABRIFORMES. PARROT-FISHES.

Percoid fishes, usually brilliantly coloured, and characterised by having the lower pharyngeals ankylosed to form a single bone; two nostrils are present on each side of the snout.

- A. Anterior teeth of jaws separate, lateral teeth usually separate from one another. Fam. *Labridae* (cxix).
 AA. Teeth of jaws coalesced to form sharp edged plates.
 B. Dorsal fin with 15-24 spines, ventrals with 4 rays. Fam. *Neodacidae* (cxx).
 BB. Dorsal fin with 9 spines, ventrals with 5 rays. Fam. *Scaridae*.

CXIX.

Family LABRIDAE.

- A. Lateral teeth of jaws free, not confluent.
 B. 8-9 dorsal spines.
 C. Operculum scaly.
 D. 11 dorsal rays.
 E. Margin of spinous dorsal with free points behind each spine *Pseudolabrus* (256).
 EE. Margin of spinous dorsal without such free points.
 DD. 12 dorsal rays. *Pictilabrus* (257).
 CC. Operculum naked. *Eupetrichthys* (258).
 F. Lateral line interrupted; forehead elevated and sharp edged.
 FF. Lateral line continuous; forehead not elevated or sharp edged.
 G. Scales larger, less than 40 in a longitudinal row.
 H. 9 dorsal spines. *Halichoeres* (260).
 HH. 8 dorsal spines. *Thalassoma* (261).
 GG. Scales smaller, more than 40 in a longitudinal row.
 I. A few small scales behind eye; lateral line less than 60. *Ophthalmolepis* (262).
 II. No scales behind eye; lateral line more than 60. *Coris* (263).
 AA. Some of the lateral teeth united to form a bony ridge on each side.
 J. 13 dorsal spines. *Choerodon* (264).
 JJ. 11-12 dorsal spines.
 K. 45 or more scales on the lateral line. *Achoerodus* (265).
 KK. 37 or less scales on the lateral line.
 L. Whole upper lip exposed when mouth is closed; snout obtuse. *Lepidaplois* (266).
 LL. Upper lip hidden posteriorly beneath preorbital when mouth is closed; snout slender. *Verrao* (267).
 256. PSEUDOLABRUS Bleeker, P. Zool. Soc. 1861 (1862), p. 415 (*rubiginosus*).
 A. Cheek-scales in 4 or more rows, extending forward to below middle of eye.
 B. Dorsal and anal fins with large scales covering their bases.
 C. Broad bands from the snout and interorbital space passing through the eye onto the body. *guntheri* (256a).
 CC. Only narrow bands radiating from the eye, sometimes wanting. *luculentus* (256b).
 BB. Dorsal and anal fins without scaly bases. *celidotus* (256c).
 AA. Cheek-scales in 1-3 rows, rarely 4 rows, usually confined to postorbital portion of head.
 D. Cheek-scales in 1 row above, usually 3 below. *tetricus* (256d).
 DD. Cheek-scales in 1 row. *gynnogenis* (256e).

- 256a. P. GUNTHERI. *Id.* Bleeker, Versl. Akad. Amsterdam xiv, 1862, p. 130; *Id.* McCulloch, Rec. Austr. Mus. ix. 3, 1913, p. 368, pl. 17 (Pl. xxx).
An uncommon species, most plentiful towards the northern border of the State. Length about 7 inches.
- 256b. P. LUCULENTUS. *Labrus luculentus* Richardson, Ichth. Erebus & Terror, 1848, p. 130. *P. luculentus* Waite, Rec. Austr. Mus. v. 1, 1903, p. 29, pl. 4, 1.
Occasionally captured in New South Wales, but more plentiful at Lord Howe Island. Length about 8 inches.
- 256c. P. CELIDOTUS. *Labrus celidotus* Bloch & Schneider, Syst. Ichth., 1801, p. 133; *Id.* Richardson, Ichth. Erebus & Terror, 1846, p. 53, pl. 31, 1-5.
This species has been recorded from New South Wales, but proof of its occurrence here is required.
- 256d. P. TETRICUS. LILAC-BANDED PARROT-FISH. *Labrus tetricus* Richardson, P. Zool. Soc. 1840, p. 25. *Pseudolabrus tetricus* McCulloch, Rec. Austr. Mus. ix. 3, 1913, p. 377, pl. 19. *P. cyanogenys* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 76, pl. 13 (Pl. xxx).
An exceedingly variable species, altering greatly in both form and colour in changing from the young to the adult. Length about 18 inches.
- 256e. P. GYMNOPENIS. WHITE-SPOTTED PARROT-FISH. *Labrichthys gymno-genis* Gunther, Brit. Mus. Cat. Fish. iv., 1862, p. 117. *Pseudolabrus gymno-genis* McCulloch, Rec. Austr. Mus. ix. 3, 1913, p. 381, pl. 20.
Another species which undergoes great changes with growth. The adult form is known as the Crimson-banded Parrot-fish. Length 12 inches.
(*Labrus cyprinaceus* Shaw, White's Voy. N.S. Wales, 1790, p. 264, pl. 1, is apparently a species of *Pseudolabrus*, but is too briefly characterised to be identified).
257. PICTILABRUS Gill, Proc. U.S. Nat. Mus. xiv., p. 403 (*laticlavius*).
257a. P. LATICLAVIUS. GREEN-BANDED PARROT-FISH. *Labrus laticlavius* Richardson, F. Zool. Soc. 1839, p. 99, and Ichth. Erebus & Terror, 1848, p. 128, pl. 56, 3-6 (Pl. xxx).
Common among weed covered rocks, and characterised by its green colour with two purple longitudinal stripes on the sides. Length about 8 inches.
258. EUPETRICHTHYS Ramsay & Ogilby, P.L.S. N.S.W. (2) ii, 1888, p. 631 (*angustipes*).
258a. E. ANGUSTIPES. SLENDER PARROT-FISH. *Id.* Ramsay & Ogilby, *Tom. cit.*, p. 632; *Id.* McCulloch, Rec. Austr. Mus. ix. 3, 1913, p. 365, pl. 15, (Pl. xxx).
A rare species, known only from three specimens from near Sydney. Length 6 inches.
259. NOVACULICHTHYS Bleeker, Proc. Zool. Soc. 1861 (1862), p. 414 (*taeniurus*).
259a. N. JACKSONENSIS. KEEL-HEADED PARROT-FISH. *Novacula jacksonensis* Ramsay, P.L.S. N.S.W. vi, 1881, p. 198. *Novaculichthys jacksonensis* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 87, pl. 15 (Pl. xxx).
A rare species, about 8 inches long.
260. HALICHOERES Ruppell, Neue Wirbelth. Fische, 1837, pp. 10, 17 (*bimaculatus*).

H. poecilus Richardson, *H. centiquadrus* Lacepede, and *H. trimaculatus* Quoy and Gaimard, have been recorded from Port Jackson, the first by Steindachner, Sitzb. Akad. Wiss. Wien liii, 1866, p. 463, the second by Waite, Rec. Austr. Mus. iv, 1901, p. 54, and the third by Kner, Novara Zool. i, Fische, 1865, p. 255. All are tropical fishes, and further proof of their occurrence on the coast of New South Wales is needed.

261. *THALASSOMA* Swainson, Nat. Hist. Fish. Amphib. Rept. ii, 1839, p. 224 (*purpurea*).

261a. *T. LUNARIS* *Labrus lunaris* Linne, Syst. Nat. 10th ed., 1758, p. 283.

Julis lunaris Bleeker, Atlas Ichth. i, 1862, p. 90, pl. 33, 5.

Another tropical species, of which the only record from Port Jackson is quite unreliable.

262. *OPHTHALMOLEPIS* Bleeker, F. Zool. Soc. 1861 (1862), p. 413 (*lineolatus*).

262a. *O. LINEOLATUS*. MAORI. *Julis lineolatus* Cuv. & Val., H. N. Poiss. xiii, 1839, p. 436. *O. lineolatus* Kner, Novara Zool. i, Fische, 1865, p. 258, pl. 11, 1 (Pl. xxx).

A common fish in the vicinity of sunken reefs. Length 16 inches.

263. *CORIS* Lacep., H. N. Poiss. iii, 1802, p. 96 (*aygula*).

A. A black comb-like band from snout to tail.

picta (263a).

AA. Two dark transverse bands on anterior part of body.

sandeyeri (263b).

263a. *C. PICTA*. *Labrus pictus* Bloch & Schneider, Syst. Ichth., 1801, p. 251, pl. 55. *C. picta* Waite, Rec. Austr. Mus. v, 1903, p. 26, pl. 5, 1 (Pl. xxx.).

Not uncommon around wharf-piles in harbours, and plentiful on the reef at Lord Howe Island. Length 9 inches.

263b. *C. SANDEYERI*. KING PARROT-FISH. *Cymolutes sandeyeri* Hector, Trans. N. Zeal. Inst. xvi., 1884, p. 323. *C. rex* McCulloch, Rec. Austr. Mus. xiii. 2, 1920, p. 67, pl. 14, 2.

A rare species, reaching a length of 26 inches.

264. *CHOERODON* Bleeker, Nat. Geneesk. Arch. Nederl. Indie iv, 1847, p. 10 (*macrodonatus*).

264a. *C. VENUSTUS*. BLUE-SPOTTED GROPER. *Choerops venustus* De Vis, Proc. Roy. Soc. Qld. i, 1885, p. 147. *Choerodon ommopterus* Roughley, Fish. Austr. 1916, p. 150, pl. 50 (Pl. xxx.).

A northern species, forwarded to Sydney from the Clarence and Richmond River estuaries. Length nearly 3 feet.

264b. *C. MACLEAYI*. *Choerops macleayi* Ramsay & Ogilby, P.L.S. N.S.W. (2) ii., 1887, p. 241.

Known only from a single example 5½ inches long, which is perhaps merely the young of *C. venustus*.

265. *ACHOERODUS* Gill, P. Acad. N. Sci. Philad. 1863, p. 222 (*gouldii*).

265a. *A. GOULDII*. BLUE GROPER. *Labrus gouldii* Richardson, A.M.N.H. xi, 1843, p. 353. *Platychoerops mulleri* Klunzinger, Sitzb. Akad. Wiss. Wien lxxx. i, 1879, p. 399, pl. 8, 2 (Pl. xxx.).

A valuable food-fish occurring around rocky coasts, and reaching a length of about 3½ feet.

The name *Trochocopus unicolor* Gunther, A.M.N.H. (4) xvii, 1876, p. 398, was based upon a stuffed skin from Port Jackson, which is probably not distinct from the Blue Groper.

Heterochoerops viridis Steindachner, Sitzb. Akad. Wiss. Wien liii, 1866, p. 461, pl. 5, 3, is evidently the very young form of *Achoerodus*, in which the preopercular margin is strongly serrated, and the tubes of the lateral line are simple instead of arborescent.

265b. A. BADIUS. BROWN GROPER. *Platychoerops badius* Ogilby, Ed. Fish. N.S. Wales, 1893, p. 134.

This is probably only a colour variation of the preceding species.

266. LEPIDAPLOIS Gill, P. Acad. N. Sci. Philad. 1862, p. 140 (*axillaris*).

266a. L. VULPINUS. *Cossyphus vulpinus* Richardson, P. Zool. Soc. 1850, p. 71. *Harpe vulpina* Waite, Rec. Austr. Mus. iv, 1902, p. 269, pl. 42 (Pl. xxx).

A rare species in New South Wales waters. Length 16 inches.

267. VERREO Jordan & Snyder, Proc. U.S. Nat. Mus. xxiv, 1902, p. 619 (*oxycephalus*).

A. A large dark spot on the spinous dorsal; body without rows of crimson spots. *oxycephalus* (267a).

AA. No dark spot on the spinous dorsal; 3 rows of crimson spots on each side of body. *bellis* (267b).

267a. V. OXYCEPHALUS. PIG-FISH. *Cossyphus oxycephalus* Bleeker, Versl. Akad. Amsterdam xiv, 1862, p. 129. *V. oxycephalus* Jordan & Snyder, Proc. U.S. Nat. Mus. xxiv, 1902, p. 619, fig. 3 (Pl. xxx).

Lives around sunken reefs, and grows to 15 inches long.

267b. V. BELLIS. BANDED PIG-FISH. *Cossyphus bellis* Ramsay & Ogilby, P.L.S. N.S.W. (2) ii, 1887, p. 561. *Diastodon bellis* Stead, Ed. Fish. N.S. Wales, 1908, p. 82, pl. 51.

Probably only a colour variety of the preceding species.

CXX.

Family NEOODACIDAE.

A. Cheeks scaly.

Neoodax (268).

AA. Cheeks naked.

B. Dorsal originating above operculum; scales about 30. *Heteroscarus* (269).

BB. Dorsal originating above pectoral; scales about 50. *Olisthops* (270).

268. NEOODAX Castelnau, Res. Fish. Austr. (Viet. Offic. Rec. Philad. Exhib), 1875, p. 37 (*waterhousii*).

The status of the older name *Odar*, which has been allotted to three different genera by Lacepede, Cuvier, and Cuvier and Valenciennes, is so uncertain that it seems to be preferable to use Castelnau's name.

A. About 60 scales on the lateral line.

semifasciatus (268a).

AA. 30-45 scales on the lateral line.

B. Lateral line about 40.

balteatus (268b).

BB. Lateral line about 45.

obscurus (268c).

268a. N. SEMIFASCIATUS. ROCK WHITING. *Odar semifasciatus* Cuv. & Val., H. N. Poiss. xiv, 1839, p. 299, pl. 407. *Odar richardsonii* Gunther, Brit. Mus. Cat. Fish. iv, 1862, p. 241; *Id.* Roughley, Fish. Austr., 1916, p. 159, pl. 55 (Pl. xxxi.).

Common along the southern portion of the coast, and reaching a length of 14 inches. There seems to be nothing to distinguish *N. richardsonii* from *N. semifasciatus*.

- 268b. *N. BALTEATUS*. LITTLE ROCK WHITING. *Odax balteatus* Cuv. & Val., H. N. Poiss. xiv, 1839, p. 303.

Not uncommon on *Zostera* flats in Port Jackson. Length 7 inches.

An examination of the holotype of *Odax brunneus* Macleay, shows that it has 38-39 scales on the lateral line, not 30 as described, and that it does not differ from *N. balteatus*.

- 268c. *N. OBSCURUS*. *Odax obscurus* Castelnau, P. Zool. Soc. Viet. i, 1872, p. 154.

Probably synonymous with the preceding species.

269. *OLISTHOPS* Richardson, P. Zool. Soc. 1850, p. 75 (*cyanomelas*).

- 269a. *O. CYANOMELAS*. HERRING CALE. *Id.* Richardson, *Ibid.*, pl. 3, 1-2; *Id.* McCulloch, Rec. Austr. Mus. xiii. 2, 1920, pl. 14, 3 (Pl. xxxi.).

A rock fish which exhibits great colour variation, the male being usually blackish, while the females are ornamented as in the accompanying figure. Length about 12 inches.

270. *HETEROSCARUS* Castelnau, P. Zool. Soc. Viet. i, 1872, p. 245 (*filamentosus*).

- 270a. *H. FILAMENTOSUS*. RAINBOW-FISH. *Id.* Castelnau, *Ibid.*; *Id.* Steindachner, Sitzb. Akad. Wiss. Wien lxxxviii. i, 1883, p. 1093, pl. 3, 1 (Pl. xxxi.).

A gorgeously coloured fish which is not uncommon around rocky reefs on the southern portion of the coast. Length about 9 inches.

(*Pseudoscarus octodon* Bleeker has been incorrectly recorded from Port Jackson by Kner, Novara Zool. i, Fische, 1865, p. 262. No member of the family Scaridae is known from the State).

GADOPSIFORMES.

CXXI.

Family GADOPSIDAE.

271. *GADOPSIS* Richardson, Ichth. Erebus & Terror, 1848, p. 122 (*marmoratus*).

- 271a. *G. MARMORATUS*. RIVER BLACKFISH. *Id.* Richardson, *Ibid.*, pl. 59, 6-11. *Id.* Ogilby, Mem. Qld. Mus. ii., 1913, p. 69, pl. xx. (Pl. xxxi.).

Occurs in the western rivers of New South Wales, and occasionally reaches 15 inches in length.

CHAMPSODONTIFORMES.

CXXII.

Family CHAMPSODONTIDAE.

272. *CHAMPSODON* Gunther, P. Zool. Soc. 1867, p. 102 (*vorax*).

The type of *Centropercis nudivittis* Ogilby apparently offers no characters to separate it from *Champsodon*.

- 272a. *C. NUDIVITTIS*. *Centropercis nudivittis* Ogilby, P.L.S. N.S.W. (2) x, 1895, p. 320; *Id.* Waite, Mem. Austr. Mus. iv. i, 1899, p. 111, pl. 11, 2 (Pl. xxxii.).

A rare species living in moderate depths on muddy ground. Length 4 inches.

TRACHINIFORMES.

- A. Dorsal fin with an anterior spinous portion.

- B. Lateral line incomplete, not reaching the tail.

Fam. *Opisthognathidae* (cxxxiii.).

- BB. Lateral line complete, reaching the tail.

Fam. *Pinguipedidae* (cxxxiv.).

- AA. Dorsal fin without spines.

- C. Palate toothless; lateral line near lower surface of body.

Fam. *Creediidae* (cxxxv.).

- CC. Palate with teeth.

D. Lateral line extending along middle or lower half of body.

E. Mandible not projecting beyond upper jaw.

Fam. *Limnichthyidae* (cxxvi.).

EE. Mandible projecting beyond upper jaw.

Fam. *Leptoscopidae* (cxxvii.).

DD. Lateral line extending along upper part of body.

Fam. *Uranoscopidae* (cxxviii.).

CXXIII.

Family OPISTHOGNATHIDAE.

273. MEROGYMNUS Ogilby, P. Roy. Soc. Qld. xxi., 1908, p. 18 (*eximius*).

273a. M. JACKSONIENSIS. LEOPARD FISH. *Opisthognathus jacksoniensis* Macleay, P.L.S. N.S.W., v., 1881, p. 570. *Gnathypops jacksoniensis* Waite, Rec. Austr. Mus. v., 1904, p. 240, pl. 26, 2 (Pl. xxxi.).

An ornate and rare fish, growing to 10 inches long.

CXXIV.

Family PINGUIPEDIDAE.

274. PARAPERCIS Bleeker, Nederl. Tijdschr. Dierk. i, 1863, p. 236 (*cylindrica*).

A. Posterior dorsal spines not shorter than the preceding ones. Subg. *Neopercis*.

B. Lateral line not following curve of back.

C. Cross-bars of back distinct; no dark blotches below lateral line.

binivirgata (274a)).

CC. Cross-bars of back indistinct; five dark blotches below lateral line

ramsayi (274b).

BB. Lateral line following curve of back; back with cross bars. *allporti* (274c).

AA. Last dorsal spine shorter than the preceding ones. Subg. *Chilias*.

D. Narrow blue-lines between eyes and across snout. *nebulosus* (274d).

274a. P. BINIVIRGATA. GRUB-FISH. *Neopercis binivirgata* Waite, Rec.

Austr. Mus. v, 1904, p. 236, pl. 25, 3 (Pl. xxxi.).

A rare species of which few specimens are known. Length 8 inches.

274b. P. RAMSAYI. *Id.* Steindachner, Sitzb. Akad. Wiss. Wien. lxxxviii.,

1, 1884, p. 1072. *Parapercis novae-cambriae* Waite, Mem. Austr. Mus.

iv., 1, 1899, p. 111, pl. 25 (Pl. xxxi.).

Another fish which has been rarely taken. Length 8 inches.

274c. P. ALLPORTI. *Percis allporti* Gunther, A.M.N.H. (4) xvii., 1876, p.

394. *P. ocularis* Waite, Mem. Austr. Mus. iv., 1, 1899, p. 109, pl. 24.

Plentiful in deep water, where it is commonly taken by trawlers. Length 13 inches.

274d. P. NEBULOSUS. *Percis nebulosus* Quoy & Gaimard, Voy. Uranie,

1825, p. 349. *Percis emeryana* Richardson, Icones Piscium, 1843, p. 4,

pl. 1, 1.

A tropical species occasionally extending southward to Port Jackson. Length 11 inches.

CXXV.

Family CREEDIIDAE.

275. CREEDA Ogilby, P.L.S. N.S.W., xxiii., 1898, p. 298 (*clathrisquamis*).

275a. C. HASWELL. *Hemerocoetes haswelli* Ramsay, P.L.S. N.S.W., vi.,

1881, p. 575. *C. clathrisquamis* Waite, Mem. Austr. Mus., iv., 1, 1899,

p. 63, fig. 6 (Pl. xxxi.).

A small and rare species taken by the dredge or trawl. Length 2 inches.

CXXVI.

Family LIMNICHTHYIDAE.

A. Vomer toothless; pectoral rays uniform.

Limnichthys (276).

AA. Vomer with teeth; lower pectoral rays thickened and modified.

Schizochirus (277).276. LIMNICHTHYS Waite, Rec. Austr. Mus. v. 3, 1904, p. 178 (*fasciatus*).276a. L. FASCIATUS. *Id.* Waite, *Ibid.*, pl. 23, 4 (Pl. xxxi.).

A minute fish not uncommon in sandy pools along the coast. Length under two inches.

277. SCHIZOCHIRUS Waite, Rec. Austr. Mus. v. 4, 1904, p. 241 (*insolens*).277a. S. INSOLENS. *Id.* Waite, *Ibid.*, p. 242, pl. 26, 3 (Pl. xxxi.).

Known only from two specimens about 2½ inches long.

CXXVII.

Family LEPTOSCOPIIDAE.

A. Scales larger, about five between lateral line and back.

Crapatalus (278).

AA. Scales smaller, more than 5 between lateral line and back.

Leptoscopus (279).278. CRAPATALUS Gunther, A.M.N.H. (3) vii., 1861, p. 86 (*novae-zelandiae*).278a. C. ARENARIUS. SAND-FISH. *Id.* McCulloch, P.L.S. N.S.W., xl., 2, 1915, p. 269, pl. 37, 1 (Pl. xxxii.).

A small species 3½ inches long, which burrows in the sand of our coastal beaches.

279. LEPTOSCOPIUS Gill, P. Acad. N. Sci. Philad. 1859, p. 133 (*macropygus*).279a. L. MACROPYGUS. *Uranoscopus macropygus* Richardson, Ichth. Erebus & Terror, 1846, p. 55, pl. 33, 4-6 (Pl. xxxii.).

Though the type specimen was said to have been obtained in Port Jackson, the species has not since been recognised from Australian waters. It reaches a length of 2 feet in New Zealand.

CXXVIII.

Family URANOSCOPIIDAE.

A. Humeral region with a fringed appendage; body scaly.

Ichthyoscopus (280).

AA. Humeral region without a fringed appendage.

B. Chin with free dilatations of the mandible; body minutely scaly.

Gnathagnus (281).

BB. Chin without free dilatations of the mandible; body naked.

Kathetostoma (282).280. ICHTHYSCOPUS Swainson, Nat. Hist. Fish. Amph. Rept. ii., 1839, p. 269 (*inermis*).280a. I. LEBECK. STARGAZER. *Uranoscopus Le Beck*, Bloch & Schneider, Syst. Ichth., 1801, p. 47. *U. inermis* Valenciennes, Illustr. Poiss. Cuv. R. Anim. 1843, p. 52, pl. 17, 3 (Pl. xxxii.).

Not uncommon, but not generally captured on account of its habit of burying itself in sand or mud. Length 15 inches.

281. GNATHAGNUS Gill, P. Acad. N. Sci. Philad. 1861, p. 115 (*elongatus*).281a. G. INNOTABILIS. *Id.* Waite, Rec. Austr. Mus. v., 1904, p. 238, pl. 26, 1 (Pl. xxxii.).

Not uncommon in moderately deep water, where it is captured by the trawlers. Length 14 inches.

282. KATHETOSTOMA Gunther, Brit. Mus. Cat. Fish. ii., 1860, p. 231 (*laeve*).282a. K. LAEVE. STONELIFTER. *Uranoscopus laevis* Bl. Schn., Syst. Ichth., 1801, p. 47, pl. 8. *K. laeue* Waite & McCulloch, Tr. Roy. Soc. S. Austr. xxxix., 1915, p. 471, pl. 13, 3.

A southern species, which burrows in mud or sand. Length 20 inches.

NOTOTHENIIFORMES.
Family BOVICHTHIDAE.

CXXIX.

A. Head and body scaly.
AA. Head and body naked.

Pseudaphritis (283).
Bovrichtus (284).

283. PSEUDAPHRITIS Castlenau, P. Zool. Soc. Vict., i., 1872, p. 92 (*bassi*).

283a. P. URVILLII. *Aphritis urvillii* Cuv. & Val., H.N. Poiss. viii., 1831, p. 484, pl. 243 (Pl. xxxii.).

A southern species, said to occur in both fresh and salt water. Length 12 inches.

(*Eleginus bursinus* Cuv. & Val., H.N. Poiss., v., 1830, p. 161, which was said to have been taken in Port Jackson, has not been recognised since it was first described, and its affinities are unknown).

284. BOVICHTHUS Cuv. & Val., H.N. Poiss., viii., 1831, p. 486 (*diacanthus*).

284a. B. VARIEGATUS. *Bovichthys variegatus* Richardson, Ichth. Erebus & Terror, 1846, p. 56, pl. 34, 1-4 (Pl. xxxii.).

A New Zealand species, said to have been originally obtained in Port Jackson, but which has not since been taken in N.S. Wales.

CALLIONYMIFORMES.
Family CALLIONYMIDAE.

CXXX.

285. CALLIONYMUS Linne, Syst. Nat. 10th. ed. 1758, p. 249 (*lyra*).

A. Preopercular spine with a basal antrorse barb below; dorsal rays mostly simple. *calcaratus* (285a).

AA. Preopercular spine without a basal antrorse barb below; dorsal rays mostly branched.

B. Preopercular spine with 2 terminal hooks.

C. 7-8 anal rays.

CC. 6 anal rays.

B. Preopercular spine with 3 hooks above.

calauropomus (285b).
papilio (285d).
phasis (285c).

285a. C. CALCARATUS. STINK-FISH. *Id.* Macleay, P.L.S. N.S.W., v., 1881, p. 628.

Not rare in Port Jackson, and remarkable for its power of producing an offensive odour. Length 10 inches. This species has been confused with *C. reevesii* Richardson, and *C. curvicornis* Cuv. & Val., in other lists.

285b. C. CALAUROPOMUS. DRAGONET. *Id.* Richardson, Ichth. Erebus & Terror, 1844, p. 10, pl. 7, 4-5 (Pl. xxxii.).

Generally taken in nets in Port Jackson. Length 10 inches.

285c. C. PHASIS. *Id.* Gunther, Challenger Zool. i., 1880, p. 28, pl. 15, c. (Pl. xxxii.).

Restricted to deep water, and so far, known from but few specimens. Length 4 inches.

285d. C. PAPILIO. PAINTED DRAGONET. *Id.* Gunther, A.M.N.H. (3) xiv., 1864, p. 197.

A small and richly coloured species. *C. lateralis* Macleay, is merely the young of *C. papilio*. Length 5 inches.

(*C. lunatus* Schlegel, has been recorded from Fort Jackson by Gunther, Challenger Zool. i., 1880, p. 28, but the identification was probably incorrect).

Suborder SCOMBROIDEA.

- A. Jaws without canines.
 - B. Snout not produced into a pointed rostrum or sword.
 - C. Mouth with lateral cleft, and well developed teeth. *Scombriformes* (cxxx.).
 - CC. Mouth small, anterior, with only feeble teeth. *Luvariformes* (cxxxii.).
 - BB. Snout forming a long pointed rostrum or sword. *Xiphiiformes* (cxxxiii.-iv.).
 - AA. Jaws with canines anteriorly. *Trichiuriformes* (cxxxv.-vi.).

SCOMBRIFORMES.

CXXXI.

Family SCOMBRIDAE.

- A. Caudal peduncle without a median keel on each side.
 - B. Scales minute; anterior dorsal spines highest. *Scomber* (286).
 - BB. Scales large; median dorsal spines highest. *Gasterochisma* (287).
 - AA. Caudal peduncle with a median keel on each side.
 - C. A single lateral line on each side.
 - D. Body largely naked except near the lateral line and corselet.
 - E. Interdorsal space wide, equal to half the head-length. *Auxis* (288).
 - EE. Interdorsal space narrow, less than one-fourth the head-length. *Euthynnus* (289).
 - DD. Body wholly covered with small scales.
 - F. Teeth subconical, little compressed; corselet distinct.
 - G. Vomer and palatines with villiform teeth. *Thunnus* (290).
 - GG. Vomer toothless, palatines with a row of conical teeth. *Sarda* (291).
 - FF. Teeth compressed; corselet obscure. *Scomberomorus* (292).
 - CC. Two lateral lines on each side. *Grammatorycnus* (293).

286. SCOMBER Linne, Syst. Nat. 10th. Ed. 1758, p. 297 (*scombrus*).

286a. S. AUSTRALASICUS. MACKEREL. *Id.* Cuvier & Valenciennes, Hist. Nat. Poiss. viii., 1831, p. 49. *S. colias* Stead, Ed. Fish. N.S. Wales, 1908, p. 94, pl. 63 (Pl. xxxiii.).

Abundant, and periodically moving along the coast in large shoals. Length 14 inches.

287. GASTEROCHISMA Richardson, A.M.N.H., xv., 1845, p. 346 (*melampus*).

287a. G. MELAMPUS. *Id.* Richardson, *Ibid.*, and Ichth. Erebus & Terror, 1846, p. 60, pl. 37, 1-3 (Pl. xxxiii.).

A very rare oceanic species, altering considerably in appearance with growth. Length over 5 feet.

288. AUXIS Cuvier, R. Anim. 2nd ed., ii., 1829, p. 199 (*rochei*).

- A. 8 dorsal and 7 anal finlets. *thazard* (288a).
- AA. 6 dorsal and 6 anal finlets. *ramsayi* (288b).

288a. A. THAZARD. FRIGATE MACKEREL. *Scomber thazard* Lacépède, H.N., Poiss. iii., 1802, p. 9. *A. vulgaris* Cuvier & Valenciennes, H.N. Poiss., viii., 1831, p. 139, pl. 216 (Pl. xxxiii.).

A widely distributed oceanic fish which occasionally appears in small shoals in Port Jackson. Length 15 inches.

288b. A. RAMSAYI. *Id.* Castelnau, P.L.S. N.S.W., iii., 1879, p. 382.

As no specimens having the characters ascribed to this species have been secured since it was first described, it is probable that the description is incorrect. *A. ramsayi* is probably synonymous with *A. thazard*.

289. EUTHYNNUS Jordan & Gilbert, Bull. U.S. Nat. Mus., xvi., 1882, p. 429 (*thunnina*).
- A. Lateral line curved below second dorsal; 4 longitudinal stripes on lower half of body. *pelamis* (289a).
- AA. Lateral line not so curved; no stripes on lower half of body. *alletterata* (289b).
- 289a. E. PELAMIS. BONITO. *Scomber pelamis* Linne, Syst. Nat. 10th. ed., 1758, p. 297. *Thynnus pelamis* Schlegel, Faun. Japon. Pisc., 1839, p. 96, pl. 49 (Pl. xxxiii.).
- An oceanic species of which the only record from New South Wales waters is unsatisfactory. Length 3 feet.
- 289b. E. ALLETTERATA. LITTLE TUNNY. *Scomber alletteratus* Rafinesque, Caratteri, 1810, p. 46. *Gymnosarda alletterata* Jordan & Evermann, Bull. U.S. Nat. Mus., No. 47-1, 1896, p. 869, pl. 134, 366.
- Occurs periodically in schools off the coast, and is occasionally captured by rod fishermen. Length 30 inches.
290. THUNNUS South, Encycl. Metropol. v., 1845, p. 620 (*thynnus*).
- A. Pectoral fin much shorter than the head. *maccoyii* (290a).
- AA. Pectoral fin as long as head. *germo* (290b).
- 290a. T. MACCOYII. SOUTHERN TUNNY. *Thynnus maccoyii* Castlenau, P. Zool. Soc. Viet., i., 1872, p. 104. *Thynnus thynnus* McCoy, Prodr. Zool. Soc. Viet., dec. v., 1880, pl. 44, 2 (Pl. xxxiii.).
- This species is possibly identical with the Tunny of the Mediterranean and Atlantic. Length 7 feet.
- 290b. T. GERMO. ALBACORE. *Scomber germo* Lacepede, H.N. Poiss. iii., 1802, p. 1. *Thynnus sibi* Schlegel, Faun. Japon. Pisc., 1844, p. 97, pl. 50.
- Though but once recognised from the New South Wales coast, this species is probably a regular visitor to our waters. Length 4 feet.
291. SARDA Cuvier, R. Anim. 2nd. ed., ii., 1829, p. 199 (*sarda*).
- 291a. S. CHILIENSIS. HORSE MACKEREL. *Pelamys chiliensis* Cuv. & Val., H.N. Poiss. viii., 1831, p. 163; *Id.* Day, Fish. India, 1876, p. 253, pl. 56, 1 (Pl. xxxiii.).
- Appears at intervals in shoals on the coast. Length about 3 feet.
292. SCOMBEROMORUS Lacepede, H.N. Poiss. iii., 1802, p. 292 (*plumieri*).
- A. Sides with bluish subvertical bars. *commersonii* (292a).
- AA. Side with dark ovate or circular spots. *guttatus* (292b).
- 292a. S. COMMERSONII. BARRED SPANISH MACKEREL. *Scomber commersonii* Shaw, Gen. Zool. iv., 1803, p. 589, pl. 85, after *S. commerson* Lacepede, H.N. Poiss., ii., 1800, p. 600, pl. 20, 1. *Cybium commersonii* Day, Fish. India, 1876, p. 255, pl. 56, 5 (Pl. xxxiii.).
- A fine fish captured by rod fishermen on the coast. Length 4½ feet.
- 292b. S. GUTTATUS. SPOTTED SPANISH MACKEREL. *Scomber guttatus* Bloch & Schneider, Syst. Ichth., 1801, p. 23, pl. 5. *Cybium guttatum* Day, Fish. India, 1876, p. 255, pl. 56, 4.
- Occurs in shoals, and is captured on the coast like the preceding species. Length 6 feet.

293. GRAMMATORYCNUS Gill, P. Acad. N. Sci. Philad., 1862, p. 125 (*bilineatus*).

- 293a. G. BICARINATUS. LARGE-SCALED TUNNY. *Thynnus bicarinatus* Quoy & Gaimard, Voy. Uranie, 1825, p. 357, pl. 61, 1. *G. bicarinatus* McCulloch, P.L.S. N.S.W., xl., 1915, p. 266, pl. 35, 1 (Pl. xxxiii.).

A little known species which probably appears at intervals on the coast of New South Wales, but which has been but rarely captured. Length 3 feet.

LUVARIFORMES.

CXXXII. Family LUVARIDAE.

294. LUVARUS Rafinesque, Caratteri, 1810, p. 22 (*imperialis*).

- 294a. L. IMPERIALIS. *Id.* Rafinesque, *Ibid.*; *Id.* Day, Fish. Gt. Brit. & Irel. i., 1880-84, p. 121, pl. 43 (Pl. xxxiii.).

A wide-world oceanic species, once recorded from N.S. Wales waters. Length 6 feet.

XIPHIIFORMES.

- A. No ventral fins or teeth in adults; scales obsolete. Fam. *Xiphiidae* (cxxxiii.).
AA. Ventral fins and teeth present; scales present. Fam. *Istiophoridae* (cxxxiv.).

CXXXIII. Family XIPHIIDAE.

295. XIPHIAS Linne, Syst. Nat. 10th. ed., 1758, p. 248 (*gladius*).

- 295a. X. GLADIUS. SPEAR-FISH. *Id.* Linne, *Ibid.*; *Id.* Day, Fish. Gt. Brit. & Irel. i., 1880-84, p. 146, pl. 49, 1-2 (Pl. xxxiv.).

Occurring in all temperate and tropical oceans. Length 15 feet.

CXXXIV. Family ISTIOPHORIDAE.

- A. Ventral rays 2 or 3; dorsal fin high and undivided. *Istiophorus* (296).
AA. A single ventral ray; dorsal low, divided in adults. *Tetrapturus* (297).

296. ISTIOPHORUS Lacepede, H.N. Poiss. iii., 1802, p. 374 (*gladifer*).

- 296a. I. GLADIUS. SAIL-FISH. *Scomber gladius* Broussonet, Mem. Acad. Sci., 1876, p. 454, pl. 10. *I. gladius* McCulloch, Rec. Aust. Mus., xiii., 4, 1921, p. 137, pl. 24, 1 (Pl. xxxiv.).

An oceanic wanderer in the tropics, sometimes ranging southward to N.S. Wales waters.

297. TETRAPTURUS Rafinesque, Caratteri, 1810, p. 54 (*belone*).

- 297a. T. INDICUS. SWORD-FISH. *Id.* Cuvier & Valenciennes, H.N. Poiss., viii., 1831, p. 286. *Histiophorus gladius* Ramsay (nec. Broussonet), P.L.S. N.S.W., v., 1881, p. 295, pl. 8 (Pl. xxxiv.).

Occurs along the coast and reaches a length of 14 feet.

TRICHIURIFORMES.

- A. Ventral fins reduced to scale-like appendages or absent. Fam. *Trichiuridae* (cxxxv.).
AA. Each ventral fin represented by a spine, with or without rays. Fam. *Gempylidae* (cxxxvi.).

CXXXV.

Family TRICHIURIDAE.

A. Caudal fin wanting, tail ending in a fine point.

Trichiurus (298).

AA. Caudal fin present.

Lepidopus (299).

298. TRICHIURUS Linne, Syst. Nat. 10th. ed., 1758, p. 246 (*lepturus*).

298a. T. COXII. HAIR-TAIL. *Id.* Ramsay & Ogilby, P.L.S. N.S.W. (2), ii., 1887, p. 562 (Pl. xxxiv., an allied species *T. lepturus*).

Occasionally appears plentifully in deeper inlets along the coast. Length 4 feet.

299. LEPIDOPUS Gouan, Hist. Pisc., 1770, p. 107 (*gouani*).

299a. L. CAUDATUS. FROST FISH. *Trichiurus caudatus* Euphrasen, Stockh. K. Vet. Akad. Nya Handl. ix., 1788, p. 52, pl. 9, 2. *L. caudatus* Day, Fish. Gt. Brit. & Irel. i., 1880-4, p. 156, pl. 51, 2 (Pl. xxxiv.).

Widely distributed in both hemispheres. A young example taken by the trawlers is the only specimen recorded from the State. Length 6 feet.

CXXXVI.

Family GEMPYLLIDAE.

A. Lateral line double; two separate rays behind dorsal and anal fins.

Jordanidia (300).

AA. Lateral line single; 5-7 finlets behind dorsal and anal fins. *Thyrsites* (301).

300. JORDANIDIA Snyder, F.U.S. Nat. Mus. xl., 1911, p. 527 (*raptoria*).

300a. J. SOLANDRI. KING BARRACOUTA. *Gempylus solandri* Cuv. & Val., H.N. Poiss. viii., 1831, p. 215. *Rexea furcifera* Waite, Rec. Cantb. Mus. i. 3, 1911, p. 236, pl. lii. (Pl. xxxiv.).

A southern species, recently captured in 150 fathoms east of Sydney by the State Trawlers. A valuable food-fish. Length 30 inches.

301. THYRSITES Cuvier, R. Anim. 2nd. ed., ii., 1829, p. 200 (*atun*).

301a. T. ATUN. BARRACOUTA. *Scomber atun* Euphrasen, Stockh. Vet. Akad. Nya Handl. xii., 1791, p. 315. *T. atun* McCulloch, Rec. Austr. Mus. xiii. 4, 1921, p. 139, pl. 24, 2 (Pl. xxxiv.).

Visits the coast periodically in large schools. Length 4 feet.

Suborders TEUTHIDOIDEA and SIGANOIDEA.

A. Anal fin with two 2 or 3 spines (*Teuthidoidea*).

B. Teeth in a single row in each jaw.

Fam. *Teuthididae* (cxxxvii.).

BB. Teeth in several rows, brush like.

Fam. *Zanclidae* (cxxxviii.).

AA. Anal fin with 7 spines (*Siganoides*).

Fam. *Siganidae* (cxxxix.).

CXXXVII.

Family TEUTHIDAE (vel ACANTHURIDAE Auct.).

A. A single movable spine on each side of the caudal peduncle. *Teuthis* (302).

AA. Three or more tubercles on the caudal peduncle.

B. Three caudal tubercles.

Xesurus (303).

BB. More than three caudal tubercles.

Prionurus (304).

302. TEUTHIS Linne, Syst. Nat. 12th. ed., 1766, p. 507 (*hepatus*).

This genus has been commonly called *Acanthurus* or *Hepatus*. It has no affinity with *Teuthis* of most authors, which now must be known as *Siganus*.

A. Body light, with dark cross bands.

triostegus (300a).

AA. Body dark, with narrow wavy lines.

grammoptilus (300b).

302a. T. TRIOSTEGUS. BANDED SURGEON-FISH. *Chaetodon triostegus* Linne, Syst. Nat. 10th. ed., 1758, p. 274. *Acanthurus triostegus* Day, Fish. India, 1876, p. 204, pl. 48, 2.

A tropical species, which wanders southwards into our waters. Length 6 inches.

302b. T. GRAMMOPTILUS. SURGEON-FISH. *Acanthurus grammoptilus* Richardson, A.M.N.H., xi., 1842, p. 176. *T. grammoptilus* McCulloch, Mem. Qld. Mus. vi., 1918, p. 92, pl. 28 (Pl. xli.).

Another tropical fish, rare on the New South Wales coast. Length 13 inches.

303. XESURUS Jordan & Evermann, Rept. U.S. Fish. Comm. 1895 (1896), p. 421 (*punctatus*).

303a. X. MACULATUS. *Prionurus maculatus* Ogilby, P. Zool. Soc. 1887, p. 395.

Occasionally captured by line on the coast. Length 17 inches.

304. PRIONURUS Lacepede, Ann. Mus. Hist. Nat. iv., 1804, p. 211 (*microlepidotus*).

304a. P. MICROLEPIDOTUS. *Id.* Lacepede, *Ibid.* *Id.* Cuv. & Val., H.N. Poiss. x., 1835, p. 295, pl. 292 (Pl. xli.).

Lives among rocks and feeds upon sea-weeds. Length 18 inches.

CXXXVIII.

Family ZANCLIDAE.

305. ZANCLUS Cuv. & Val., H.N. Poiss. vii., 1831, p. 102 (*cornutus*).

305a. Z. CANESCENS. MOORISH IDOL. *Chaetodon canescens* Linne, Syst. Nat. 10th. ed., 1758, p. 272. *Z. cornutus* Day, Fish. India, 1875, p. 111, pl. 28, 4 (Pl. xli.).

A tropical species which only rarely strays southward of Queensland. Length 7 inches.

Suborder SIGANOIDEA.

CXXXIX.

Family SIGANIDAE.

306. SIGANUS Forskal, Descr. Anim., 1775, pp. x, 25 (*rivulatus*).

A. Body with light spots above and stripes below. *javus* (306a).

AA. Body with irregular dark brown spots. *nebulosus* (306b).

306a. S. JAVUS. *Teuthis javus* Linne, Syst. Nat. 12th. ed., 1766, p. 507; *Id.* Day, Fish. India, 1875, p. 165, pl. 39, 5 (Pl. xli.).

A tropical species, occasionally ranging into New South Wales waters.

306b. S. NEBULOSUS. BLACK TREVALLY. *Amphacanthus nebulosus* Quoy & Gaimard, Voy. Uranie, 1825, p. 369. *Siganus nebulosus* Stead, Ed. Fish. N.S. Wales, 1908, p. 81, pl. 49.

Occasionally plentiful in Port Jackson, and more plentiful northwards. Length 10 inches.

(*S. sutor* Cuv. & Val., has been included in a list of New South Wales fishes by Waite, Mem. N.S. Wales Nat. Club, ii., 1904, p. 36, and Kner, Novara Zool., i., 1865, p. 207, has recorded *S. heragonta* Bleeker, from Sydney. It is unlikely that either species occurs within the waters of this State).

Suborder GOBIOIDEA.

Family GOBIIDAE.

- CXL.
 A. Ventral fins more or less united, with an anterior membrane connecting their spines. Subfam. *Gobiinae* (307-312).
 AA. Ventral fins separate, no anterior membrane between their spines. Subfam. *Electrinae* (313-317).

Subfamily GOBIINAE.

- A. Soft dorsal and anal short, free from the caudal.
 B. Head with prominent raised papillose ridges. *Callogobius* (311).
 BB. Head with only microscopic papillae in rows.
 C. Upper pectoral rays forming free filaments. *Bathygobius* (308).
 CC. Upper pectoral rays normal, not free.
 D. Scales larger, 50 or less in a longitudinal row.
 E. Operculum naked. *Gobius* (309).
 EE. Operculum scaly.
 F. 30 or less scales between operculum and tail. *Gobius australis* (309a).
 FF. 31-47 scales between operculum and tail. *Mujilogobius* (307).
 DD. Scales smaller, about 90 in a longitudinal row. *Cryptocentrus* (310).
 AA. Soft dorsal and anal long, partly united with the caudal; D.VI./38-48. *Leme* (312).

307. MUGILOGOBIUS Smitt, Ofv. Vet. Akad. Forh., 1899, p. 543 (*abei*).

307a. M. DEVISI. *Id.* McCulloch & Ogilby, Rec. Austr. Mus. xii., 10, 1919, p. 223, pl. 36, 2.

Specimens in the Australian Museum were collected near Trial Bay by Mr. J. R. Kinghorn, Jan. 1920. Length nearly 2 inches.

308. BATHYGOBIUS Bleeker, Arch. Neerl. Sci. Nat., xiii., 1878, p. 54 (*nebulopunctatus*).

308a. B. KREFFTI. *Gobius krefftii* Steindachner, Sitzb. Akad. Wiss. Wien. liii. i., 1866, p. 451. *Mapo krefftii* McCulloch & Ogilby, Rec. Austr. Mus. xii. 10, 1919, p. 234, pl. 33, 4 (Pl. xxxv.).

Abundant in inlets along the coast. Length about 3 inches.

The specimen recorded by Gunther, Challenger Zool. i., 1880, p. 28, as *G. albopunctatus* Cuv. & Val., from Port Jackson, is evidently referable to *B. krefftii*.

309. GOBIUS Linne, Syst. Nat. 10th. ed., 1758, p. 262 (*niger*).

None of the following species are referable to *Gobius* in its restricted sense, but are retained within the genus until their true generic positions can be determined.

- A. Operculum scaly; head much compressed in adults. *australis* (309a).
 AA. Operculum naked; head not compressed.
 B. Nape and greater portion of neck naked.
 C. Breast and base of pectoral naked. *lidwulli* (309b).
 CC. Breast and base of pectoral scaly.
 D. Upper surface of head without spots; dorsal fins longitudinally banded. *bifrenatus* (309c).
 DD. Upper surface of head with dark spots; dorsal fin with oblique rows of grey spots. *semifrenatus* (309d).
 DDD. *G. frenatus* apparently comes near here. *frenatus* (309e).
 BB. Nape and neck scaly. *lateralis*, var. *obliquus* (309f).

309a. G. AUSTRALIS. *Gillichthys australis* Ogilby, P.L.S. N.S.W. (2) ix., 1894, p. 367. *Gobius australis* McCulloch, Rec. Austr. Mus. xi. 7, 1917, p. 187, pl. 31, 3 (Pl. xxxv.).

A minute species, 2 inches long, of which adult males are remarkably compressed and have huge mouths extending far backward.

- 309b. *G. LIDWILLI*. *Id.* McCulloch, Rec. Austr. Mus. xi. 7, 1917, p. 185, pl. 31, 2 (Pl. xxxv.).

One of the smallest of vertebrate animals, adults being little more than half an inch in length.

- 309c. *G. BIFRENATUS*. BRIDLED GOBY. *Id.* Kner, Novara Zool. i., Fische, 1865, p. 177, pl. 7, 3.

Plentiful on muddy ground and among sea-grass, where it is taken in prawn-nets. Length 6 inches.

- 309d. *G. SEMIFRENATUS*. *Id.* Macleay, P.L.S. N.S.W., v., 1881, p. 598; *Id.* McCulloch & Ogilby, Rec. Austr. Mus. xii. 10, 1919, p. 214, pl. 34, 2 (Pl. xxxv.).

Commonly associated with, and very similar to the preceding species.

- 309e. *G. FRENATUS*. *Id.* Gunther, Brit. Mus. Cat. Fish. iii., 1861, p. 39; *Id.* Kner, Novara Zool. i., Fische, 1865, p. 174.

Apparently similar to the preceding species. Length 4 inches.

- 309f. *G. LATERALIS*, var. *OBLIQUUS*. *Id.* McCulloch & Ogilby, Rec. Austr. Mus. xii. 10, 1919, p. 249, pl. 34, 4.

Common in shallow water in inlets along the coast. Length about 2½ inches.

310. *CRYPTOCENTRUS* Cuv. & Val., Hist. Nat. Poiss. xii., 1837, p. 111 (*cryptocentrus*).

- 310a. *C. GOBIOIDES*. CRESTED GOBY. *Gobius gobioides* Ogilby, Cat. Fish. N.S. Wales, 1886, p. 35. *C. gobioides* McCulloch & Ogilby, Rec. Austr. Mus. xii. 10, 1919, p. 255, pl. 36, 1 (Pl. xxxv.).

Not uncommon on muddy grounds, and remarkable for its bright colouration. Length about 4 inches.

311. *CALLOGOBIUS* Bleeker, Arch. Neerl. Sci. Nat. ix., 1874, p. 318 (*hasseltii*).

- 311a. *C. HASSELTII*, var. *MUCOSUS*. *Gobius mucosus* Gunther, P. Zool. Soc., 1871, p. 663, pl. 63, a. *C. hasseltii* var. *mucosus* McCulloch & Ogilby, Rec. Austr. Mus., xii. 10, 1919, p. 217, pl. 32, 4 (Pl. xxxv.).

A southern species which is not uncommon along the coast. Length about 4 inches.

312. *LEME* De Vis, P.L.S. N.S.W. viii., 1883, p. 286 (*mordax*).

- 312a. *L. PURPURASCENS*. *Id.* De Vis, P.L.S. N.S.W., ix., 1884, p. 698; *Id.* McCulloch & Ogilby, Rec. Austr. Mus. xii. 10, 1919, p. 206, pl. 31, 3 (Pl. xxxv.).

An elongate fish with minute eyes, and scaleless body, which lives in estuaries of rivers. Length about 9 inches.

(Tenison Woods, Fish. & Fisher, N.S.W., 1882, p. 27, intimates the occurrence of *Periophthalmodon barbarus* Linne, which is almost certainly incorrect).

Subfamily ELEOTRINAE.

- A. Top of head without bony crests.

B. Cheeks and opercles naked.

BB. Opercles scaly, cheeks more or less scaly.

C. Interorbital space scaly.

CC. Interorbital space naked.

D. Scales smaller, 37-40.

DD. Scales larger, 27-35.

- AA. Top of head with bony crests.

Philypnodon (313).

Mogurnda (314).

Gobiomorphus (315).

Carassiops (316).

Butis (317).

313. PHILYPNODON Bleeker, Arch. Neerl. Sci. Nat. ix., 1874, p. 301 (*nudiceps*).

313a. P. GRANDICEPS. FLAT-HEADED GUDGEON. *Eleotris grandiceps* Krefft, P. Zool. Soc., 1864, p. 183. *P. grandiceps* Waite, Rec. Austr. Mus. v., 1904, p. 285, pl. 36, 2 (Pl. xxxv.).

Plentiful in streams and waterholes around Sydney. Length $3\frac{1}{2}$ inches.

314. MOGURNDA Gill, P. Acad. N. Sci. Philad., 1863, p. 270 (*mogurnda*).

A. Dorsal with 11-13 rays, body spotted.

adpersus (314a).

AA. Dorsal with 9 rays, body striped.

australis (314b).

314a. MOGURNDA MOGURNDA ADSPERSUS. PURPLE-SPOTTED GUDGEON. *Eleotris adpersus* Castlenau, P.L.S. N.S.W. iii., 1878, p. 142. *Kreftius adpersus* Waite, Rec. Austr. Mus. v., 1904, p. 282, pl. 35, 1 (Pl. xxxvi.).

Occurs in the western rivers of the State, and in a few of the northern coastal streams. Length $4\frac{1}{2}$ inches.

(*Eleotris striata* Steindachner, Sitzb. Akad. Wiss. Wien liii., 1866, p. 452, from Port Jackson, is apparently near *M. m. adpersus*).

314b. M. AUSTRALIS. STRIPED GUDGEON. *Eleotris australis* Krefft, P. Zool. Soc., 1864, p. 183. *Kreftius australis* Waite, Rec. Austr. Mus. v., 1904, p. 283, pl. 35, 2 (Pl. xxxvi.).

Occurs in the eastern rivers of the State. Length 7 inches.

315. GOBIOMORPHUS Gill, F. Ac. N. Sci. Philad. 1863, p. 270 (*gobioides*).

315a. G. COXII. GUDGEON. *Eleotris coxii* Krefft, P. Zool. Soc. 1864, p. 183. *Kreftius coxii* Waite, Rec. Austr. Mus. v. 5, 1904, p. 283, pl. 36, 1 (Pl. xxxvi.).

Plentiful in the Nepean River system. Length 7 inches.

316. CARASSIOPS Ogilby, P.L.S. N.S.W. xxi., 1897, p. 732 (*compressus*).

A. Second dorsal with 9-10 rays.

compressus (316a).

AA. Second dorsal with 11-14 rays.

subg. *Austrogobio*.

B. Mediolateral scales without dark markings.

galii (316b).

BB. Each mediolateral scale with a dark vertical bar.

klunzingeri (316c).

316a. C. COMPRESSUS. CARP GUDGEON. *Eleotris compressus* Krefft, P. Zool. Soc., 1864, p. 184. *C. compressus* Waite, Rec. Austr. Mus. v., 1904, p. 280, pl. 34, 1 (Pl. xxxvi.).

A species which is very variable in both form and colouration. Restricted to the eastern rivers in New South Wales. Length 4 inches.

316b. C. GALII. FIRE-TAILED GUDGEON. *Id.* Ogilby, P.L.S. N.S.W. xxii. 4, 1898, p. 788. *Id.* Waite, Rec. Austr. Mus. v., 1904, p. 281, pl. 34, 2 (Pl. xxxvi.).

Common in southern Queensland, and introduced into the Botanic Gardens, Sydney. Length about 2 inches.

316c. C. KLUNZINGERI. WESTERN CARP GUDGEON. *Id.* Ogilby, P.L.S. N.S.W. xxii., 1898, p. 787. *Id.* McCulloch & Ogilby, Rec. Austr. Mus. xii. 10, 1919, p. 289, pl. 37, 2-3.

Occurs in all the western streams of the State, and remarkable for the difference in appearance of the two sexes. Length $2\frac{1}{2}$ inches.

317. *BUTIS* Bleeker, Nat. Tijd. Ned. Ind. xi., 1856, p. 412 (*butis*).

317a. *B. AMBOINENSIS*. *Eleotris amboinensis* Bleeker, Nat. Tijd. Ned. Ind. v., 1853, p. 343. *B. amboinensis* McCulloch & Ogilby, Rec. Austr. Mus. xii. 10, 1919, p. 271, pl. 36, 4 (Pl. xxxvi.).

A northern species, recorded from the Tweed River estuary. Length 6 inches.

Suborder BLENNIOIDEA.

Family BLENNIIDAE.

CXLI.

A. One or two dorsal fins.

B. Teeth slender and flattened, forming a comb-like row in each jaw; lateral canines present.

C. Gill-openings wide, separated by a narrow isthmus. *Blennius* (318).

CC. Gill-openings narrow, lateral.

D. Dorsal and anal fins not united with caudal; body shorter.

E. Gill-opening entirely above base of pectoral. *Petroscirtes* (319).

EE. Gill-opening partly in front of base of pectoral.

Aspidontus (320).

DD. Dorsal and anal fins united with caudal; body elongate.

Xiphasia (321).

BB. Jaws without either rows of comb-like teeth or large lateral canines.

F. Three anterior dorsal spines forming a separate fin above the head.

G. First dorsal spine over or in advance of eye. *Cristiceps* (322).

GG. First dorsal spine behind vertical of eye. *Petraites* (323).

FF. A single dorsal fin, almost or entirely composed of spines.

H. Vomer with teeth. *Opnicleus* (324).

HH. Palate toothless. *Sticharium* (325).

AA. Three dorsal fins.

I. Lateral line interrupted.

J. Head scaly.

JJ. Head naked.

Gillias (326).

Tripterygion (327).

II. Lateral line complete.

Lepidoblennius (328).

318. *BLENNIUS* Linne, Syst. Nat. 10th ed., 1758, p. 256 (*ocellaris*).

318a. *B. TASMANIANUS*. *Id.* Richardson, P. Zool. Soc., 1839, p. 99. *Id.* Waite, Rec. Austr. Mus. vi., 1906, p. 205, pl. 36, 5 (Pl. xxxvi.).

A southern species, which extends northward along the N.S. Wales Coast. Length 5 inches.

319. *PETROSCIRTES* Ruppell, Fische Roth. Meer, 1828, p. 110 (*mitratus*).

A. Teeth forming a nearly straight row across the front of each jaw.

variabilis (319a).

AA. Teeth forming a curved row around each jaw.

B. A crest usually present above the head; body much compressed.

anolius (319b).

BB. No crest above the head; body thicker.

rotundiceps (319c).

319a. *P. VARIABILIS*. SABRE-TOOTHED BLENNY. *Id.* Cantor, Cat. Malay. Fish., 1850, p. 200; *Id.* Day, Fish. India, 1876, p. 327, pl. 69, 7.

A widely distributed species. Length 5 inches.

319b. *P. ANOLIUS*. OYSTER BLENNY. *Blennechis anolius* Cuv. & Val., H.N. Poiss. xi., 1836, p. 288. *P. anolius* McCulloch, Austr. Zool. i. 4, 1917, p. 90, pl. 10, 2 (Pl. xxxvii.).

A remarkable little fish which lives in the empty shells of oysters where it deposits its eggs and guards them until they are hatched. Length 3 inches.

319c. *P. ROTUNDICEPS*. *Id.* Macleay, P.L.S. N.S.W. vi., 1881, p. 9.

A brightly coloured species, with fine blue lines on the sides. Length 3½ inches.

(*P. solorensis* Bleeker, has been incorrectly recorded from Sydney by Kner, Novara Zool. i., Fische, 1865, p. 196).

320. *ASPIDONTUS* Quoy & Gaimard, Voy. Astrolabe iii., 1834, p. 719 (*taeniatus*).

320a. A. MAROUBRAE. *Macrurhynchus maroubrae* Ogilby, P.L.S. N.S.W. xxi., 1896, p. 137. *A. maroubrae* McCulloch, Austr. Zool. i. 4, 1917, p. 92, pl. 10, 1 (Pl. xxxvii.).

A rare species only 2 inches long.

321. *XIPHASIA* Swainson, Nat. Hist. Fish. Amph. Rept. ii., 1839, p. 259 (*setifer*).

321a. X. SETIFER. HAIR-TAILED BLENNY. *Id.* Swainson, *Ibid.*; *Id.* Day, Fish. India, 1876, p. 337, pl. 73, 1 (Pl. xxxvii.).

A pelagic fish, which occasionally strays southward to Fort Jackson. Length 20 inches.

322. *CRISTICEPS* Cuvier & Valenciennes, H.N. Poiss. xi., 1836, p. 402 (*australis*).

A. Anterior spine just before front margin of eye.

aurantiacus (322a).

AA. Anterior spine over front half of eye.

argyropleura (322b).

AAA. Anterior spine over hinder portion of eye.

australis (322c).

322a. C. AURANTIACUS. CRESTED WEED-FISH. *Id.* Castlenau, P.L.S. N.S.W. iii., 1879, p. 386. *Id.* McCulloch, Rec. Austr. Mus. vii. 1, 1908, p. 38, pl. 10, 1 (Pl. xxxvii.).

Common among weeds in estuaries. Length 10 inches.

322b. C. ARGYROPLEURA. *Id.* Kner, Novara Zool. I, Fische I, 1865, p. 199, pl. 7, 4.

Similar to, but not so common as the preceding species.

322c. C. AUSTRALIS. *Id.* Cuv. & Val., H.N. Poiss. xi., 1836, p. 402, pl. 336. Very common among weeds. Length 9 inches.

323. *PETRAITES* Ogilby, P.L.S. N.S.W. x., 1885, p. 226 (*heptaeolus*).

A. Body deep, its depth more than a fifth of the total length.

B. 35 equidistant dorsal rays.

roseus (323a).

BB. 3 dorsal rays, an interspace between the 1st and 2nd.

heptaeolus (213b).

AA. Body narrower, its depth less than a fifth of the total length.

fasciatus (213c).

Cristiceps antiectes and *C. nasutus* are apparently near *P. fasciatus*.

323a. P. ROSEUS. *Cristiceps roseus* Gunther, Brit. Mus. Cat. Fish., iii., 1861, p. 274. *P. roseus* McCulloch, Rec. Austr. Mus. vii. 1, 1908, p. 40, pl. 10, 4 (Pl. xxxvii.).

Fairly common among weeds in rock-pools along the coast. Length 5 inches.

323b. P. HEPTAEOLUS. *Id.* Ogilby, P.L.S. N.S.W. x., 1885, p. 226; *Id.* McCulloch, Rec. Austr. Mus., vii. 1, 1908, p. 41, pl. 11, 1.

Similar to and occurring with the preceding species.

- 323c. *P. FASCIATUS*. *Cristiceps fasciatus* Macleay, P.L.S. N.S.W., vi., 1881, p. 19. *P. fasciatus* McCulloch, Rec. Austr. Mus. vii. 1, 1908, p. 42, pl. 11, 2.

Extremely plentiful in rock-pools on the coast. Length $2\frac{1}{2}$ inches.

- 323d. *F. ANTINETES*. *Cristiceps antinectes* Gunther, Brit. Mus. Cat. Fish. iii., 1861, p. 273-footnote.

A species which has been only imperfectly characterised, and is but little known.

- 323e. *P. NASUTUS*. *Cristiceps nasutus* Gunther, Brit. Mus. Cat. Fish. iii., 1861, p. 273.

Another little known species, nearly 2 inches long, which has not been recognised since first described.

324. *OPHICLINUS* Castlenau, P. Zool. Soc. Viet. i., 1872, p. 246 (*antarcticus*).

- 324a. *O. GRACILIS*. *Ophioclinus gracilis* Waite, Rec. Austr. Mus. vi. 3, 1906, p. 207, pl. 36, 6 (Pl. xxxvii.).

Not uncommon in rock-pools on the coast. Length $2\frac{1}{2}$ inches.

325. *STICHARIUM* Gunther, A.M.N.H. (3) xx., 1867, p. 63 (*dorsale*).

- 325a. *S. DORSALE*. *Id.* Gunther, *Ibid.*

An apparently rare species, supposed to have been obtained in Port Jackson, but which has not been collected since first described.

326. *GILLIAS* Evermann & Marsh, Rept. U.S. Fish. Comm. xxv., 1899, p. 357 (*jordani*).

- 326a. *G. STRIATICEPS*. *Tripterygium striaticeps* Ramsay & Ogilby, P.L.S. N.S.W. (2) iii., 1888, p. 419.

Occurs in rock-pools in Port Jackson. Length $1\frac{1}{2}$ inches.

327. *TRIPTERYGION* Risso, Hist. Nat. Europ. Merid. iii., 1826, p. 241 (*nasus*).

- 327a. *T. ANNULATUM*. *Tripterygion annulatum* Ramsay & Ogilby, P.L.S. N.S.W. (2) ii., 1888, p. 1021.

Very plentiful in rock-pools, and varying from bright green to scarlet. Length about 2 inches.

328. *LEPIDOBLENNIUS* Steindachner, Sitzb. Akad. Wiss. Wien lv. i., 1867, p. 11 (*haplodactylus*).

- 328a. *L. HAPLODACTYLUS*. JUMPING JOEY. *Id.* Steindachner, *Ibid.*, p. 12, pl. 1, 2-3 (Pl. xxxvi.).

Abundant on the coast, where it is commonly observed out of water sunning itself on the wet rocks. It skips into the nearest pool when alarmed. Length 4 inches.

Suborder OPHIDIOIDEA.

- A. Ventrals inserted near the chin below the glossohyal; dorsal and anal fins confluent with the caudal. Fam. *Ophidiidae* (cxlii.).

- AA. Ventrals jugular, attached to the humeral arch; caudal fin free in N.S. Wales species. Fam. *Brotulidae* (cxliii.).

CXLII.

Family OPHIDIIDAE.

A. Mandible with an enlarged outer row of teeth, and an inner narrow band of smaller ones.

AA. Mandible with a narrow band of strong subequal teeth. *Genypterus* (329).
Otophidium (330).

329. GENYPTERUS Phillipi, Arch. Naturg. xxiii. i, 1857, p. 268 (*nigricans*).

329a. G. BLACODES. ROCKLING. *Ophidium blacodes* Bloch & Schneider, Syst. Ichth., 1801, p. 484. *Genypterus australis* McCoy, Prodr. Zool. Vict. dec. iii., 1879, pl. 21, 1 (Pl. xxxvii—an allied species *G. microstomus*).

A southern species, occasionally captured on the N.S. Wales coast. Length 3 feet.

330. OTOPHIDIUM Jordan, Rept. U.S. Fish. Comm., 1885 (1887), p. 126 (*omostigma*).

330a. O. GENYOPUS. Id. Ogilby, P.L.S. N.S.W. xxii., 1897, p. 93.

Known from a single shrivelled specimen, 3 inches long, which is possibly the young of the preceding species.

CXLIII.

Family BROTLIDAE.

A. Scales imperfect, approximate posteriorly, spaced anteriorly.

AA. Scales well formed and imbricate. *Dermatopsis* (331).
Monothrix (332).

331. DERMATOPSIS Ogilby, P.L.S. N.S.W. xxi., 1896, p. 138 (*macrodon*).

331a. D. MACRODON. Id. Ogilby, *Ibid.*, p. 140.

A translucent, flesh-coloured fish, which lives in rock-pools on the coast. Length 3 inches.

332. MONOTHRIX Ogilby, P.L.S. N.S.W. xxii., 1897, p. 87 (*polylepis*).

332a. M. POLYLEPIS. Id. Ogilby, *Ibid.*, p. 88.

Known from a single specimen which is little more than two inches long.

SUCKER-FISHES. Order DISCOCEPHALI.

Elongate fishes with tough leathery skin, and long laminated sucktorial discs upon the upper surface of their heads. These discs enable them to cling to sharks, large fishes, and boats, by which they are carried about without effort to themselves.

CXLIV.

Family ECHENEIDIDAE.

A. Inner ventral rays united by membrane, free from the abdomen. *Echeneis* (333).

AA. Inner ventral rays attached to abdomen by membrane. *Remora* (334).

333. ECHENEIS Linne, Syst. Nat. 10th ed., 1758, p. 260 (*naucrates*).

333a. E. NAUCRATES. SLENDER SUCKER-FISH. Id. Linne, Syst. Nat. 10th ed., 1758, p. 261; Id. Day, Fish. India, 1876, p. 257, pl. 57, 1 (Pl. xxxiv.).

A world-wide species, which is common on this coast. Length 3 feet.

334. REMORA Gill, P. Acad. N. Sci. Philad. 1862, p. 239 (*remora*).

334a. R. REMORA. SHORT SUCKER-FISH. *Echeneis remora* Linne, Syst. Nat. 10th ed., 1758, p. 260; Id. Day, Fish. Gt. Brit. & Irel. i., 1880-84, p. 108, pl. 39, 2 (Pl. xxxiv.).

Occurs in all temperate and tropical seas, but is less common on this coast than the preceding species. Length 12 inches.

Order SCLEROPAREI.

A large and diversified group, known as the Mailed-cheek Fishes, in which a posterior projection from the suborbital bones extends backward across the cheek to the preoperculum. A scheme for the classification of the Order has been compiled by Regan (A.M.N.H. (8) xi., 1913, p. 169). The following provisional key is applicable to the species of New South Wales only.

- A. Head not markedly depressed, deeper than broad.
 - B. Head not completely encased in bony armature.
 - C. Body partly or entirely scaly. Fam. *Scorpaenidae* (cxlv.).
 - CC. Body naked.
 - D. Ventral fins present. Fam. *Aploactidae* (cxlvi.).
 - DD. No ventral fins. Fam. *Pataecidae* (cxlvii.).
 - BB. Head completely encased in bony armour.
 - E. Two anterior dorsal spines separate; pectoral reaching tail. Fam. *Cephalacanthidae* (cxlviii.).
 - EE. No detached dorsal spines; pectorals not reaching tail. Fam. *Triglidae* (cxlix.).
- AA. Head greatly depressed, much broader than deep.
 - F. Body naked, with a row of spinate bucklers on each side. Fam. *Hoplichthyidae* (cli.).
 - FF. Body scaly, without enlarged bucklers. Fam. *Platycephalidae* (cli.).

CXLV.

Family SCORPAENIDAE.

- A. Dorsal spines not greatly produced, largely united by membrane.
 - B. Less than 15 dorsal spines.
 - C. 12 dorsal spines.
 - D. Bony stay of cheek with several spines; lower part of operculum naked. *Scorpaena* (335).
 - DD. Bony stay of cheek nearly smooth; lower part of operculum scaly. *Helicolenus* (336).
 - CC. 13 dorsal spines.
 - E. Palatine teeth present. *Neosebastes* (337).
 - EE. Palatines toothless. *Scorpaenodes* (338).
 - BB. 15 or more dorsal spines.
 - F. A broad and deep hollow on the nape behind the eyes. *Glyptauchen* (339).
 - FF. No such hollow across the nape.
 - G. Back scaly anteriorly, 15 dorsal spines. *Eotesthes* (340).
 - GG. Back naked anteriorly, 16 dorsal spines. *Centropogon* (341).
- AA. Dorsal spines long and slender, united by membrane only at their bases. *Pterois* (342).

335. SCORPAENA Linne, Syst. Nat. 10th ed., 1758, p. 266 (*porcus*).

- A. 50-55 scales in a row below the lateral line. *cardinalis* (335a).
- AA. 45 or less scales in a row below the lateral line. *cruenta* (335b).

335a. S. CARDINALIS. RED ROCKCOD. *Id.* Richardson, A.M.N.H. ix., 1842, p. 212. *S. jacksoniensis* Steindachner, Sitzb. Akad. Wiss. Wien liii., 1866, p. 438, pl. 3, 2-2a (Pl. xxxviii.).

A rock fish, plentiful in the markets, and reaching 18 inches in length.

335b. S. CRUENTA. *Id.* Richardson, A.M.N.H., ix., 1842, p. 217. *S. militaris* Richardson, Ichth. Erebus & Terror, 1845, p. 22, pl. 14, 1-2.

A southern species, apparently rare in this State.

(*S. bynoensis* Richardson, has been incorrectly recorded from Fort Jackson—*vide* McCulloch, Rec. W. Austr. Mus. i. 2, 1912, p. 96).

336. *HELICOLENUS* Goode & Bean, *Oceanic Ichth.*, 1895, p. 248 (*dactylopterus*).

336a. *H. PERCOIDES*. RED GURNET PERCH. *Sebastes percoides* Richardson, A.M.N.H. ix., 1842, p. 384, and *Ichth. Erebus & Terror*, 1845, p. 23, pl. 15, 1-2 (Pl. xxxviii.).

Common in deeper water, where it is captured by trawlers. Length 12 inches.

337. *NEOSEBASTES* Guichenot, *Mem. Soc. Sci. Nat. Cherbourg* xiii., 1868, p. 83 (*panda*).

A. More than 40 pores on lateral line.

scorpaenoides (337a).

AA. Less than 40 pores on lateral line.

thetidis (337b)

337a. *N. SCORPAENOIDES*. SPOTTED GURNET PERCH. *Id.* Guichenot, *Mem. Soc. Sci. Nat. Cherbourg* xiii., 1868, p. 85; *Id.* McCoy, *Prodr. Zool. Viet. dec. xx.*, 1890, pl. 193 (Pl. xxxviii.).

A southern species, not common in this State. Length about 12 inches.

337b. *N. THETIDIS*. ROUGH GURNET PERCH. *Sebastes thetidis* Waite, *Mem. Austr. Mus.* iv. 1, 1899, p. 100, pl. 20 (Pl. xxxviii.).

Common in deeper water, where it is taken by the trawlers. Length 13 inches.

338. *SCORPAENODES* Bleeker, *Nat. Tijds. Nederl. Ind.* xiii., 1857, p. 371 (*polylepis*).

338a. *S. SCABER*. PIGMY GURNET PERCH. *Sebastes scaber* Ramsay & Ogilby, *F.L.S. N.S.W.* x., 1886, p. 577. *Sebastopsis scaber* McCulloch, *Rec. Austr. Mus.* ix. 3, 1913, p. 387, pl. 13, 2.

A small species, which is not common, about 3 inches long.

339. *GLYPTAUCHEN* Gunther, *Brit. Mus. Cat. Fish.* ii., 1860, p. 121 (*panduratus*).

339a. *G. PANDURATUS*. GOBLIN-FISH. *Apistus panduratus* Richardson, *P. Zool. Soc.* 1850, p. 58, pl. 1, 3-4 (Pl. xxxviii.).

A rare species of grotesque appearance, which lives among rocks. Length 6 inches.

340. *NOTESTHES* Ogilby, *P. Roy. Soc. Qld.* xviii., 1903, p. 17 (*robustus*).

340a. *N. ROBUSTA*. BULLROUT. *Centropogon robustus* Gunther, *Brit. Mus. Cat. Fish.* ii., 1860, p. 128. *Centropogon troschelii* Steindachner, *Sitzb. Akad. Wiss. Wien* liii., 1866, p. 440, pl. 4, 1 (Pl. xxxviii.).

Common in estuaries, and ascends rivers. It inflicts a painful wound with its preorbital spines. Length 12 inches.

341. *CENTROPOGON* Gunther, *Brit. Mus. Cat. Fish.* ii., 1860, p. 128 (*australis*).

341a. *C. AUSTRALIS*. FORTESQUE. *Cottus australis* Shaw, *White's Voy. N.S. Wales*, 1790, p. 266, fig. 1; *Neosebastes australis* Waite, *Mem. Austr. Mus.* iv. 1, 1899, p. 103, pl. 21 (Pl. xxxviii.).

Very plentiful at certain seasons in estuaries, and well known because of its power of stinging with its preorbital spines. Length 6 inches.

342. *PTEROIS* Oken, *Isis*, 1817, p. 1182 (*volitans*).

A. Pectoral rays simple, the membrane deeply cleft between the upper ones. *volitans* (342a).

AA. Some of the pectoral rays branched, the membrane not deeply cleft. *zebra* (342b).

- 342a. P. VOLITANS. RED FIRE-FISH. *Gasterosteus volitans* Linne, Syst. Nat. 10th ed., 1758, p. 296. *Pseudomonopterus volitans* Bleeker, Atlas Ichth. ix., 1878, p. 412, 3 (Pl. xxxviii.).

A widely distributed species in the tropics, which occasionally wanders southward along the north coast of this State. Length 12 inches.

- 342b. P. ZEBRA. FIRE-FISH. *Id.* Cuv. & Val., H.N. Poiss. iv., 1829, p. 367. *Pseudomonopterus zebra* Bleeker, Atlas Ichth. ix., 1878, pl. 411, 1.

Another occasional straggler from the tropics into our waters. Length 8 inches.

(*Gymnapistes marmoratus* Cuv. & Val., was incorrectly recorded from Port Jackson—vide McCulloch, Biol. Res. Endeavour, iii. 3, 1915, p. 161, pl. 36, 2. The record of *Synanceja horrida* Linne, from Port Jackson, is likewise incorrect—vide Ogilby, Cat. Fish. N.S. Wales, 1886, p. 22).

CXLVI.

Family APLOACTIDAE.

343. APLOACTIS Schlegel, Faun. Japon. Pisc., 1843, p. 51 (*aspera*).

- 343a. A. MILESII. VELVET-FISH. *Id.* Richardson, P. Zool. Soc. 1850, p. 60, pl. 1, 1-2 (Pl. xl.).

A curious little fish which is not often captured. Length about 7 inches.

CXLVII.

Family PATAECIDAE.

344. PATAECUS Richardson, A.M.N.H. xiv., 1844, p. 280 (*fronto*).

- 344a. P. FRONTO. RED-INDIAN FISH. FOREHEAD-FISH. *Id.* Richardson, *Ibid.*, and Ichth. Erebus & Terror, 1845, p. 20, pl. 13, 1-2 (Pl. xl.).

A remarkable species of grotesque form, and scarlet in colour. Length 9 inches.

(*P. maculatus* Gunther, has been wrongly recorded from Port Jackson—Ogilby, Cat. Fish. N.S. Wales, 1886, p. 39).

CXLVIII.

Family CEPHALACANTHIDAE.

345. DACTYLOPTENA Jordan & Richardson, P.U.S. Nat. Mus. xxxiii., 1908, p. 665 (*orientalis*).

- 345a. D. ORIENTALIS. FLYING GURNARD. *Dactylopterus orientalis* Cuv. & Val., H.N. Poiss. iv., 1829, p. 134, pl. 76. *Cephalacanthus orientalis* Jordan & Evermann, Bull. U.S. Fish. Comm. xxiii. i., 1905, p. 473, fig. 208 (Pl. xxxix.).

A tropical fish which sometimes extends southward to this coast. Its enlarged pectoral fins enable it to fly short distances through the air. Length 12 inches.

CXLIX.

Family TRIGLIDAE.

- A. A row of spinigerous bucklers along bases of both dorsal fins.

- B. Scales larger, 50-60 on lateral line.

- C. Lateral line not armed with spinigerous plates.

Lepidotrigla (346).

- CC. Lateral line armed with spinigerous plates.

Paratrigla (347).

- BB. Scales smaller, 100 or more on lateral line.

Chelidonichthys (348).

- AA. Large bucklers along base of spinous dorsal only.

Pterygotrigla (349).

346. LEPIDOTRIGLA Gunther, Brit. Mus. Cat. Fish. ii., 1860, p. 196 (*aspera*).
 A. Interorbital space only slightly concave; profile convex before the eyes. *mulhali* (346a).
 AA. Interorbital space deeply concave; profile not convex before the eyes.
 B. Pectoral fin shorter than the head. *modesta* (346b).
 BB. Pectoral fin longer than the head. *argus* (346c).
 346a. L. MULHALLI. *Id.* Macleay, P.L.S. N.S.W. viii., 1884, p. 460; *Id.*
 Waite, Mem. Austr. Mus. iv. 1, 1899, p. 105, pl. 22.
 Taken by trawlers in deeper water along the coast. Length 8 inches.
 346b. L. MODESTA. *Id.* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 106, pl.
 23 (Pl. xxxix.).
 Occurs with the preceding species. Length $7\frac{1}{2}$ inches.
 346c. L. ARGUS. *Id.* Ogilby, New Fish. Qld. Coast, 1910, p. 123.
 A Queensland species, which has been recorded from 27 fathoms off Cape
 Byron, New South Wales. Length 7 inches.

347. PARATRIGLA Ogilby, Ann. Qld. Mus. x., 1911, p. 56 (*pleuracanthica*).
 347a. P. PAPILIO. BUTTERFLY GURNARD. *Trigla papilio* Cuvier & Valenciennes, H.N. Foiss. iv., 1829, p. 80, pl. 73. *T. pleuracanthica* Richardson, Ichth. Erebus & Terror, 1845, p. 23, pl. 16, 1-4 (Pl. xxxix.).
 A small and ornate species, which is occasionally captured along the coast. It has been recorded by some authors under the name *papilio*, and by others as *pleuracanthica*, but I am unable to find any characters to distinguish these as separate species. Length about 7 inches.

348. CHELIDONICHTHYS Kaup, Arch. Naturg., 1873, p. 87 (*hirundo*).
 348a. C. KUMU. RED GURNARD. *Trigla kumu* Lesson & Garnot, Voy. Coquille, 1826, p. 214, pl. 19 (Pl. xxxix.).
 A widely distributed species which is common along the coast. Length 21 inches.

349. PTERYGOTRIGLA Waite, Mem. Austr. Mus. iv. 1, 1899, p. 108 (*polyommata*).
 A. Interorbital space markedly concave; body plain. *polyommata* (348a).
 AA. Interorbital space little concave; body with brown spots. *picta* (348b).
 349a. P. POLYOMMATA. LATCHET. *Trigla polyommata* Richardson, P. Zool. Soc. 1839, p. 96, and Tr. Zool. Soc. iii., 1842, p. 87, pl. 5, 2 (Pl. xxxix.).
 Abundant in deeper waters where it is captured by trawlers. Length 20 inches.
 349b. P. PICTA. PAINTED GURNARD. *Trigla picta* Gunther, Challenger Zool. 1, 1880, p. 24, pl. 13, a; *Id.* Waite, Rec. Cantb. Mus. 1. 3, 1911, p. 252, pl. 55 (Pl. xxxix.).
 A deep-water species, recently taken by trawlers east of Sydney in 150 fathoms. Length 14 inches.

CL. Family HOPLICHTHYIDAE.

350. HOPLICHTHYS Cuvier & Valenciennes, H.N. Poiss. iv., 1829, pp. xix., 264 (*langsдорffi*).
 350a. H. HASWELLI. SPINY FLATHEAD. *Id.* McCulloch, Rec. Austr. Mus. vi. 5, 1907, p. 351, pl. 64 (Pl. xl.).
 Abundant in deeper waters, and a good table fish notwithstanding its forbidding appearance. Length 17 inches.

CLI.

Family PLATYCEPHALIDAE.

- A. Head largely scaly; no enlarged, thickened scales on the lateral line.
 B. Vomerine teeth forming a curved band across the bone; cranial ridges not serrated or spinose. *Platycephalus* (351).
 BB. Vomerine teeth in two separate groups, cranial ridges armed with spines and serratures. *Insidiator* (352).
 AA. Head almost naked; scales of lateral line enlarged and thickened. *Thysanophrys* (353).

351. PLATYCEPHALUS Bloch, *Ausl. Fische* ix., 1795, p. 96 (*spathula*).

- A. Jaws and palate without canines. subg. *Platycephalus*.
 B. Upper surface of cranium with some exposed bony ridges.
 C. Teeth not uniform, some on premaxillary symphysis, vomer, and palatines more or less enlarged.
 D. Interorbital space equal to or greater than transverse diameter of eye (except in young). Tail dusky with darker spots and white margins.
 E. Interorbital space nearly flat; head dusky with brown spots. *fuscus* (351a).
 EE. Interorbital space concave; head and body marbled. *marmoratus* (351b).
 DD. Interorbital space narrower than transverse diameter of eye.
 F. 13 dorsal rays; eye diameter equal to about half its distance from end of mandible; 3 or more black longitudinal stripes along tail from base to tip. *arenarius* (351c).
 FF. 14 dorsal rays; eye diameter greater than half its distance from end of mandible; black markings confined to posterior half of tail. *caeruleopunctatus* (351d).
 CC. Teeth small and uniform without larger ones on premaxillary symphysis, vomer, or palatines; lower preopercular spine very large. *longispinis* (351e).
 BB. No exposed bony ridges on upper surface of cranium. *laevigatus* (351f).
 AA. Jaws and palate with large canines. subg. *Neoplatycephalus*.
 G. About 11 gill-rakers on first arch, which are slender. *macrodon* (351g).

351a. *P. FUSCUS*. DUSKY FLATHEAD. *Id.* Cuvier & Valenciennes, H.N. Poiss. iv., 1829, p. 241; *Id.* Quoy & Gaimard, Zool. Astrolabe iii., 1835, p. 681, pl. 10, 1 (Pl. xl.).

A choice table-fish, of which large numbers are captured in inlets along the whole coast-line. Length 40 inches.

351b. *P. MARMORATUS*. MARBLED FLATHEAD. *Id.* Stead, New Fish. N.S. Wales, 1908, p. 9, pl. 3-5; *Id.* McCulloch, Biol. Res. Endeavour iv. 4, 1916, p. 197, pl. 57, 1.

Occurs on the northern portion of the coast. Length about 20 inches.

351c. *P. ARENARIUS*. SAND FLATHEAD. *Id.* Ramsay & Ogilby, P.L.S. N.S.W. x., 1886, p. 577; *Id.* McCulloch, Biol. Res. Endeavour iii. 3, 1915, p. 164, pl. 13. 1 (Pl. xl.).

A northern species, readily distinguished by the black longitudinal stripes on its tail. Length about 12 inches.

351d. *P. CAERULEOPUNCTATUS* *nom. nov.* SAND FLATHEAD. *Platycephalus bassensis* Stead, Ed. Fish. N.S. Wales, 1908, p. 112, pl. 78 (not *P. bassensis* Cuvier & Valenciennes).

The common Sand Flathead of New South Wales has been incorrectly recorded by various authors as *P. bassensis*, but it differs from that species in its somewhat stronger dentition, and in the greater development of its cranial ridges. Its colour and marking also is different to that of *P. bassensis*. As the species is without a name, I use *caeruleopunctatus* for it, this being a suitable name under which it has been labelled in the Australian Museum.

- 351e. *P. LONGISPINIS*. LONG-SPINED FLATHEAD. *Id.* Macleay, P.L.S. N.S.W. ix., 1884, p. 170.
 Captured by line fishermen on the coast. Length 12 inches.
- 351f. *P. LAEVIGATUS*. SMOOTH FLATHEAD. *Id.* Cuvier & Valenciennes, H.N. Poiss. iv., 1829, p. 248; *Id.* Quoy & Gaimard, Zool. Astrolabe iii., 1835, p. 684, pl. 10, 4.
 A southern species, forwarded to Sydney from the south coast of the State.
 Subgenus *NEOPLATYCEPHALUS* Castlenau, F. Zool. Soc. Vict. i., 1872, p. 87 (*grandis*).
- 351g. *P. NEOPLATYCEPHALUS MACRODON*. TIGER FLATHEAD. *Id.* Ogilby, P.L.S. N.S.W. x., 1885, p. 226.
 A deeper water species, captured in abundance by trawlers. Length 14 inches.
352. *INSIDIATOR* Jordan & Snyder, P.U.S. Nat. Mus. xxiii., 1900, p. 368 (*rudis*).
- A. Anterior third of lateral line with distinct upstanding spines. *jugosus* (352a).
 AA. Only a few anterior scales of lateral line with spines.
 B. Teeth of palate enlarged, cardiform. *diversidens* (352b).
 BB. Teeth villiform. *nematophthalmus* (352c).
- 352a. *I. JUGOSUS*. *Id.* McCulloch, Biol. Res. Endeavour ii. 3, 1914, p. 144, pl. 30, 2 (Pl. xl.).
 A northern species, which occasionally extends southward to Port Jackson. Length 8 inches.
- 352b. *I. DIVERSIDENS*. *Id.* McCulloch, Biol. Res. Endeavour, ii. 3, 1914, p. 148, pl. 31, 1.
 Three specimens were trawled in 48 fathoms off Port Stephens. Length 11 inches.
- 352c. *I. NEMATOPHTHALMUS*. *Platycephalus nematophthalmus* Gunther, Brit. Mus. Cat. Fish. ii., 1860, p. 184, and Fische Sudsee v., 1876, p. 166, pl. 107, c.
 A common species in Queensland. Two specimens are in the Australian Museum from Wallis Lake, New South Wales. Length 12 inches.
353. *THYSANOPHRYS* Ogilby, P.L.S. N.S.W. xxiii., 1898, p. 40 (*cirronasus*).
- 353a. *T. CIRRONASUS*. ROCK FLATHEAD. *Platycephalus cirronasus* Richardson, Ichth. Erebus & Terror, 1848, p. 114, pl. 51, 7-10 (Pl. xl.).
 An ornate species, variegated with many tints to harmonise with the colours of the weed-covered rocks among which this species lives. Length 15 inches.

Order XENOPTERI.

Small fishes which cling to stones by means of an adhesive disc between and behind the ventral fins.

CLII.

CLING-FISHES. Family GOBIESCIDAE.

354. *DIPLOCREPIS* Gunther, Brit. Mus. Cat. Fish. iii., 1861, p. 506 (*puniceus*).
 A. Bases of dorsal and anal fins longer than caudal peduncle; 7-10 dorsal and 6-8 anal rays. *costatus* (354a).
 AA. Bases of dorsal and anal fins shorter than caudal peduncle; 5 dorsal and 5 anal rays. *parvipinnis* (354b).

354a. *D. COSTATUS*. CLING-FISH. *Id.* Ogilby, P.L.S. N.S.W. x., 1885, p. 270; *Id.* Waite, Rec. Austr. Mus. v., 1904, p. 179, pl. 34, 1 (Pl. xxxvii.). Common in rock-pools, and of a pale flesh-colour. Length $2\frac{1}{2}$ inches.

354b. *D. PARVIPINNIS*. LITTLE CLING-FISH. *Id.* Waite, Rec. Austr. Mus. vi. 3, 1906, p. 202, pl. 36, 3 (Pl. xxxvii.).

Attaches itself to weeds in rock-pools on the coast. Length 1 inch.

(*Crepidogaster tasmaniensis* Gunther, is recorded from Sydney by Kner, Novara Zool. i., 1867, p. 277, but as it has not been since obtained here, the record is regarded as incorrect).

Order PEDICULATI.

A. Gill-openings wide, vertical, in front of base of pectorals.

Suborder *Batrachoidea* (cliii.).

AA. Gill-openings smaller, above, behind, or below base of pectorals.

Suborder *Lophioidea* (cliv-clvi.).

Suborder BATRACHOIDEA.

CLIII.

Family BATRACHOIDAE.

355. *PSEUDOBATRACHUS* Castlenau, Res. Fish. Austr. (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 24 (*striatus*).

355a. *P. DUBIUS*. FROG-FISH. *Lophius dubius* Shaw, White's Voy. N.S. Wales, 1790, p. 265, and figure. *P. dubius* McCulloch, Rec. W. Austr. Mus. i. 3, 1914, p. 224, fig. 1 (Pl. xli.).

Common in muddy places in estuaries. Length 12 inches.

The specimen recorded from Sydney by Kner, Novara Zool. i., 1865, p. 189, as *Batrachus trispinosus* is apparently referable to *P. dubius*.

Suborder LOPHIOIDEA.

A. Body not flattened, more or less compressed.

B. Spinous dorsal represented by three separate rays, the first being above the snout. Fam. *Antennariidae* (cliv.).

BB. Second and third rays of spinous dorsal united by membrane.

Fam. *Brachionichthyidae* (clv.).

AA. Body flattened forming a rounded disc.

Fam. *Ogcocephalidae* (clvi.).

CLIV.

ANGLER-FISHES.—Family ANTENNARIIDAE.

A. Skin naked.

Histrio (356).

AA. Skin beset with bristles or spines.

Antennarius (357).

356. *HISTRIO* Fischer, Zoog. Tab. Synop. Illustr. 3rd. ed., i., 1813, p. 70, 78 (*histrio*)—*vide* Jordan, Gen. Fish. i., 1917, p. 84. A name of uncertain status.

356a. *H. HISTRIO*. MARBLED ANGLER. *Lophius histrio* Linne, Syst. Nat. 10th. ed., 1758, p. 327. *Antennarius marmoratus* Gunther, Fische Sudsee v., 1876, p. 162, pl. 100, a (Pl. xli.).

A widely distributed species in temperate and tropical seas, which lives among seaweeds. Length 5 inches.

357. *ANTENNARIUS* Cuvier, Reg. Anim. 1st ed., ii., 1817, p. 310 (*chironectes*).

A. Body marked with blackish stripes.

striatus (357a).

AA. Body not striped.

B. Body and fins almost black.

commersonii (357b).

BB. Body reddish with darker markings.

nummifer (357c).

- 357a. *A. STRIATUS*. STRIPED ANGLER. *Lophius striatus* Shaw, Nat. Miscel. v., 1794, pl. 175. *A. striatus* Gunther, Fische Sudsee v., 1876, p. 162, pl. 99, b (Pl. xli.).

A. pinniceps Cuv. & Val. which occurs in New South Wales, appears to be merely a colour-variation of *A. striatus* in which the stripes and spots on the body and fins are not so well developed as in the typical form. Length 7 inches.

- 357b. *A. COMMERSONII*. BLACK ANGLER. *Chironectes commersonii* Cuvier, Mem. Mus. Hist. Nat. iii., 1817, p. 431. *A. commersonii* Bleeker, Atl. Ichth. v., 1865, p. 20, pl. 197, 3.

Occasionally captured on muddy ground where it lies in wait for the prey attracted by its flesh-coloured bait. Length 5 inches.

- 357c. *A. NUMMIFER*. SCARLET ANGLER. *Chironectes nummifer* Cuvier, Mem. Mus. Hist. Nat. iii., 1817, p. 430. *A. nummifer* Bleeker, Atlas Ichth. v., 1865, p. 18, pl. 198, 2.

A tropical species, occasionally extending southward to Port Jackson. Length 6 inches.

CLV. Family BRACHIONICHTHYIDAE.

358. BRACHIONICHTHYS Bleeker, Nat. Tijds. Ned. Ind. vii., 1854, p. 121 (*hirsutus*).

- 358a. *B. HIRSUTUS*. HAND-FISH. *Lophius hirsutus* Lacep., Ann. Mus. Hist. Nat. iv., 1804, pp. 202, 210, pl. 55, 3.

A southern species, which is only taken in deep water on the New South Wales coast. Length about 3 inches.

CLVI. Family OGCOCEPHALIDAE.

359. HALIEUTAEA Cuvier & Valenciennes, H.N. Poiss. xii., 1837, p. 455 (*stellata*).

- 359a. *H. BREVICAUDA*. *Id.* Ogilby, New Fish. Qld. Coast, 1911, p. 138; *Id.* McCulloch, Biol. Res. Endeavour ii. 3, 1914, p. 163, pl. xxxiii. (Pl. xli.).

Specimens are captured by trawlers in deep water. Length 6 inches.

Order PLECTOGNATHI.

- A. Spinous dorsal represented by one or more spines above the head.
 B. Body covered with large bony plates. Fam. *Balistidae* (clvii.).
 BB. Body covered with minute scales which may be rough or velvety. Fam. *Monacanthidae* (clviii.).
 AA. No anterior spinous dorsal.
 C. Body encased in an immovable carapace of hexagonal plates. Fam. *Ostraciidae* (clix.).
 CC. Body covered with spines or prickles, or naked.
 D. Caudal region normal, with a caudal peduncle.
 E. Each jaw divided by a median suture; body naked or with small prickles. Fam. *Tetraodontidae* (clx.).
 EE. Both jaws undivided by a median suture; body with strong spines. Fam. *Diodontidae* (clxi.).
 DD. Body subcircular, compressed, truncated behind dorsal and anal fins. Fam. *Molidae* (clxii.).

CLVII.

Family BALISTIDAE.

360. *BALISTES* Linne, Syst. Nat. 10th. ed., 1758, p. 327 (*vetula*).

360a. B. JACKSONIANUS. *Id.* Quoy & Gaimard, Voy. Uranie, Zool., 1824, p. 209.

A tiny specimen, 1½ inches long, was obtained in Port Jackson in 1824, but no other representative of the species has since been collected.

(*Balistes vidua* Richardson, was recorded from Port Jackson by Ogilby, Fish. N.S. Wales, 1886, p. 61, but the data accompanying his specimen was quite unreliable. *Balistes maculatus* Linne, has likewise been incorrectly recorded from Sydney by Kner, Novara Zool. i., 1867, p. 401).

CLVIII.

Family MONACANTHIDAE.

A. Pubic bone ending in one or more spines.

B. Pelvic spine movable.

C. Body and dorsal spine without or with small cutaneous filaments.

Monacanthus (361).

CC. Body and dorsal spine with large cutaneous filaments.

Chaetodermis (362).

Cantherines (363).

BB. Pelvic spine fixed.

AA. Pubic bone without a terminal spine.

D. Dorsal and anal fin long, with 42-46 rays.

Osbeckia (364).

DD. Dorsal and anal fins with less than 30 rays.

Brachaluteres (365).

361. *MONACANTHUS* Oken, Isis, 1817, p. 1181-3 (*chinensis*).

A. Ventral cutaneous expansion large, extending beyond the pelvic spine in adults. *chinensis* (361a).

AA. Ventral cutaneous expansion smaller, not extending beyond the pelvic spine.

B. More than 30 anal rays.

C. D. 29-33, A. 31-33.

sulcatus (361b).

CC. D. 35, A. 37.

filicauda (361c).

BB. Less than 30 anal rays.

D. Each scale with 3-5 spinules directed backward.

tomentosus (361d).

DD. Each scale with a single upstanding spinule.

nitens (361e).

361a. *M. CHINENSIS*. FAN-BELLIED LEATHER-JACKET. *Balistes chinensis*

Osbeck, Reise Ost. Indien China, 1765, p. 147. *M. chinensis* Bleeker,

Atlas Ichth. v., 1869, p. 125, pl. 222, 2 (Pl. xlii.).

Very common in Port Jackson, where it swims leisurely among weed-covered rocks in search of the small organisms upon which it feeds.

M. megalourus Richardson, has also been commonly recognised from New South Wales. This is said to differ from *chinensis* in having larger scales and a more slender dorsal spine, but it is probable that these are variable characters, and that the two species are synonymous. Length 10 inches.

361b. *M. SULCATUS*. *Id.* Hollard, Ann. Sci. Nat. (4) ii., 1854, p. 363, pl.

14, 3. *M. isogramma* Bleeker, Atlas Ichth. v., 1869, p. 128, pl. 222, 1.

This species was introduced into a New South Wales list by Ogilby, Cat. Fish. N.S.W., 1886, p. 63, upon unreliable authority.

361c. *M. FILICAUDA*. *Id.* Gunther, Challenger Zool. i., 1880, p. 50, pl. 23, d (Pl. xlii.).

A northern species, rarely wandering southward to Sydney. Length 5 inches.

361d. *M. TOMENTOSUS*. *Balistes tomentosus* Linne, Syst. Nat. 10th. ed., 1758, p. 328. *Id.* Bleeker, Atlas Ichth. v., 1869, p. 127, pl. 220, 1.

Another tropical species of which the New South Wales records are very unreliable. Length 5 inches.

- 361e. M. NITENS. SILVER LEATHER-JACKET. *Id.* Hollard, Ann. Sci. Nat. (4) ii., 1854, p. 364, pl. 14, 4.

A diminutive species, less than 2 inches long, which is rarely stranded on our ocean beaches.

362. CHAETODERMIS Swainson, Nat. Hist. Fish. Amph. Rept. ii., 1839, p. 327 (*spinosissimus*).

- 362a. C. PENNICILLIGERUS. PRICKLY LEATHER-JACKET. *Monacanthus penicilligerus* Cuvier, Reg. Anim. 2nd. ed., ii., 1829, p. 374. *C. penicilligerus* Bleeker, Atlas Ichth. v., 1869, p. 129, pl. 221, 3 (Pl. xlii.).

Though occurring in Queensland, the records of this species from New South Wales need verification.

363. CANTHERINES Swainson, Nat. Hist. Fish. Amph. Rept. ii., 1839, p. 327 (*nasutus*).

- A. Depth at origins of dorsal and anal fins less than half the length to the hypural joint.
 B. Pubic spine distinct; caudal peduncle shorter than the interdorsal space.
 C. Depth at origin of dorsal and anal fins less than length of head.
 ayraudi (363a).
 CC. Depth at origin of dorsal and anal fins greater than length of head.
 D. Less than 30 anal rays; scales very coarse. *granulatus* (363b).
 DD. More than 30 anal rays.
 E. Skin beset with minute equidistant spines.
 F. No brush of setae between dorsal and anal fins; D. 35-38, A. 33-36. *hippocrepsis* (363c).
 FF. A brush of setae between dorsal and anal fins; D. 31-33, A. 31-32. *guntheri* (363d).
 EE. Skin beset with spines which are not equidistant but in groups of 2-5.
 G. Each scale with 3-5 strong spines, united at their bases; D. 36-39, A. 33-35. *trachylepis* (363e).
 GG. Each scale with 2-3 slender spines which are juxtaposed but not united; D. 33-35, A. 31-36. *setosus* (363f).
 BB. Pubic spine obsolete, length of caudal peduncle subequal to interdorsal space.
 H. A blue stripe from chin, through eye, to middle of side, and many blue spots. *spilomelanurus* (363g).
 HH. Greenish, with brown spots. *maculosus* (363h).
 AA. Depth at origins of dorsal and anal fins half or more than half of length to hypural joint; pubic spine small or obsolete. *mosaicus* (363j).

Cantherines convexirostris, *castlenau*, *prasinus*, *freycineti*, and *rudis* are omitted from the above key, because certain of their structural details, necessary for the determination of their affinities, are unknown to me.

- 363a. C. AYRAUDI. CHINAMAN LEATHER-JACKET. *Balistes ayraudi* Quoy & Gaimard, Voy. Uranie, Zool., 1824, p. 216, pl. 47, 2. *Pseudomonacanthus ayraudi* Roughley, Fish. Austr., 1916, p. 188, pl. 66.

The young are plentiful in inlets while adults are more commonly captured in deeper water. Length 20 inches.

- 363b. C. GRANULATUS. ROUGH LEATHER-JACKET. *Balistes granulatus* Shaw, White's Voy. N.S. Wales, 1790, p. 295 & figure. *Monacanthus granulatus* Richardson, Ichth. Erebus & Terror, 1846, p. 63, pl. 40, 1-2 (Pl. xlii.).

Common in inlets along the coast. Length 9 inches.

- 363c. *C. HIPPOCREPIS*. VARIABLE LEATHER-JACKET. *Balistes hippocrepis* Quoy & Gaimard, Voy. Uranie, Zool., 1824, p. 212. *Aleuterius variabilis* Richardson, Ichth. Erebus & Terror, 1846, p. 67, pl. 52, 1-7 (Pl. xlii.).

A common species, altering considerably in both form and colouration with growth. Length 18 inches.

C. freycineti Quoy & Gaimard, was originally described from Mauritius, but Hollard, Ann. Sci. Nat. (4) ii., 1854, p. 336, pl. 12, 3, later reported it from New South Wales. The species has not since been recognised from Australia, however, and it seems probable that his New South Wales examples were incorrectly identified as *C. freycineti*. He noted their similarity to *C. variabilis*.

- 363d. *C. GUNTHERI*. TOOTH-BRUSH LEATHER-JACKET. *Monacanthus guntheri* Macleay, P.L.S. N.S.W. vi., 1881, p. 314. *M. browni* McCoy, Prodr. Zool. Viet. dec. xiii., 1886, pl. 124 (Pl. xlii.—not *Aleuterius brownii* Richardson).

A southern species, characterised by the possession of a remarkable brush of long setae on each side. Length 10 inches.

- 363e. *C. TRACHYLEPIS*. YELLOW-FINNED LEATHER-JACKET. *Monacanthus trachylepis* Gunther, Brit. Mus. Cat. Fish. viii., 1870, p. 248 (Pl. xlii.). Occurs in inlets, sometimes in schools. Length 16 inches.

The specimen recorded by Castlenau from Port Jackson as *Monacanthus rudis*, P.L.S. N.S.W. iii., 1879, p. 399, had 38 dorsal rays and other characters of *C. trachylepis*, and was probably referable to this species. As no other authors have recognised *C. rudis* from New South Wales, it seems probable that the species does not occur here.

- 363f. *C. SETOSUS*. VELVET LEATHER-JACKET. *Monacanthus setosus* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 91, pl. 16. *C. setosus* Waite & McCulloch, Tr. Roy. Soc. S. Austr. xxxix., 1915, p. 472, pl. 14.

Common in deep water along the coast, and frequently taken by trawlers. Length 11 inches.

- 363g. *C. SPILOMELANURUS*. *Balistes spilomelanurus* Quoy & Gaimard, Voy. Uranie, Zool., 1824, p. 217. *Aleuterius paragaudatus* Richardson, Ichth. Erebus & Terror, 1846, p. 66, pl. 39, 1-4 (Pl. xlii.).

Common around wharf-piles and on weedy flats in Port Jackson. Length 5 inches.

- 363h. *C. MACULOSUS*. *Aleuterius maculosus* Richardson, Ichth. Erebus & Terror, 1846, p. 67, pl. 39, 5-7.

Found commonly with the preceding species, of which it is probably merely a sexual form. Length 5 inches.

- 363i. *C. PRASINUS*. *Monacanthus prasinus* Castlenau, F. Zool. Soc. Viet. i., 1872, p. 205.

This species, described from a specimen under 3 inches long, has not been recognised by anybody but Castlenau.

- 363j. *C. MOSAICUS*. MOSAIC LEATHER-JACKET. *Monacanthus mosaicus* Ramsay & Ogilby, P.L.S. N.S.W. (2) i., 1886, p. 5. *C. mosaicus* McCulloch, Biol. Res. Endeavour iii. 3, 1915, p. 170, pl. 37, 1-2.

A deep and smooth skinned species, ornamented with mosaic-like colour-marking. Length 16 inches.

- 363k. *C. CASTLENAUI*. *Monacanthus peronii* Castlenau P.L.S. N.S.W. iii., 1879, p. 398 (not *M. peronii* Holland). *M. castlenau* Macleay, P.L.S. N.S.W. vi., 1881, p. 316—substitute name.

The few characters given in Castlenau's paper are insufficient for the recognition of this species. It is doubtless synonymous with one of the preceding species.

(*C. platifrons* Holland, has been incorrectly included in New South Wales lists on the authority of Gunther, Brit. Mus. Cat. Fish. viii., 1870, p. 229, who erroneously gave New South Wales as the locality of the holotype instead of King George's Sound.

C. convexirostris Gunther was included without comment in a mere list of New South Wales fishes by Castlenau, but it has not since been recognised from these waters).

364. *OSBECKIA* Jordan & Evermann, Rept. U.S. Fish. Comm. 1895 (1896), p. 424 (*scripta*).

- 364a. *O. MACULICAUDA*. *Monacanthus maculicauda* Ogilby, Cat. Fish. N.S. Wales, 1886, p. 64.

A very rare species. Length 7 inches.

365. *BRACHALUTERES* Bleeker, Nat. Tijd. Dierk. iii., 1866, p. 13 (*trossulus*).

- 365a. *B. TROSSULUS*. *PIGMY LEATHER-JACKET*. *Aleuterius trossulus* Richardson, Ichth. Erebus & Terror, 1846, p. 68, pl. 40, 5-6, (Pl. xlii.).

Very common on weedy flats and around wharf-piles and jetties. Length 3½ inches.

CLIX.

Family OSTRACIIDAE.

- A. Carapace closed behind the anal fin.

- B. Carapace with four or five angles.

- BB. Carapace with three angles.

- AA. Carapace not closed behind the anal fin.

Ostracion (366).
Lactophrys (367).
Anoplocapros (368).

366. *OSTRACION* Linne, Syst. Nat. 10th ed., 1758, p. 330 (*cubicus*).

- A. Large spines on middle of back and supralateral ridges; supraorbital spines shorter than eye; caudal rays with several branches. *diaphanum* (366a).

- AA. Median dorsal and supralateral spines small or wanting; supraorbital spines longer than eye; caudal rays mostly bifurcate. *cornutus* (366b).

- 366a. *O. DIAPHANUS*. *BOX-FISH*. *Ostracion diaphanus* Bloch & Schneider, Syst. Ichth., 1801, p. 501. *O. cornutus* Bleeker, Atlas Ichth. v., 1865, p. 33, pl. 204, 3 (not *O. cornutus* Linne).

A tropical species which is sometimes stranded on our ocean beaches. Length 9 inches.

- 366b. *O. CORNUTUS*. *COW-FISH*. *Id.* Linne, Syst. Nat. 10th. ed., 1758, p. 331. *O. arcus* Bleeker, Atlas. Ichth. v., 1865, p. 35, pl. 202, 3 (Pl. xliii.).

Another tropical species, occasionally wandering southward to Port Jackson. Length 15 inches.

367. *LACTOPHRYS* Swainson, Nat. Hist. Fish. Amph. Rept. ii., 1839, p. 324 (*trigonus*).

- 367a. *L. STELLIFER*. *TURRET-FISH*. *Ostracion stellifer* Bloch & Schneider, Syst. Ichth., 1801, p. 499, pl. 98. *Lactophrys tritropis* Snyder, Proc. U.S. Nat. Mus. xlii., 1912, p. 424, pl. 54, 1 (Pl. xliii.).

A widely distributed species, often stranded on our ocean beaches. Length 6 inches.

368. ANOPOLOCAPROS Kaup, Arch. Naturg. xxi., 1855, p. 220 (*lenticularis*).

368a. A. LENTICULARIS. BOX-FISH. *Ostracion lenticularis* Richardson, P. Zool. Soc. 1841, p. 21. *Aracana lenticularis* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 95, pl. 17-18.

Commonly captured in nets on the coast. Length 12 inches.

CLX.

Family TETRAODONTIDAE.

A. Each nostril a bifid tentacle, without distinct openings. *Tetraodon* (369).

AA. Each nostril with 2 distinct openings, usually in a low tube or papilla. *Spheroides* (370).

369. TETRAODON Linne, Syst. Nat. 10th. ed., 1758, p. 332 (*lineatus*).

A. Dorsal and anal fins each with 10-12 rays.

B. Back and sides with narrow longitudinal dark lines. *immaculatus* var. *manillensis* (369a).

BB. Back and sides without such lines.

C. Body with striking colour-marking, not uniform.

D. Back with white spots; belly usually striped with black. *hispidus* (369b).

DD. Back with brown spots; belly with or without black stripes or spots. *aerostaticus* (369c).

CC. Colouration largely uniform.

E. A blackish ring around the pectoral fin; skin nearly smooth. *armilla* (369d).

EE. Orange with scattered black spots; skin intensely bristly. *nigropunctatus* var. *citrinellus*, (369e).

AA. Dorsal and anal fins each with 14 rays; body covered with rounded white spots. *firmamentum* (369f).

369a. T. IMMACULATUS, var. MANILLENSIS. *Tetraodon manillensis* Proce, Bull. Philom., 1822, p. 130. *T. virgatus* Richardson, Ichth. Erebus & Terror, 1846, p. 62, pl. 39, 8-9.

A variety of *T. immaculatus* which is uniformly coloured and without the dark longitudinal lines characteristic of var. *manillensis*. Length 10 inches.

369b. T. HISPIDUS. *Id.* Linne, Syst. Nat. 10th. ed., 1758, p. 333. *Crayracion laterna* Bleeker, Atlas Ichth. v., 1865, p. 71, pl. 205, 3.

A tropical species, which is not reliably recorded from New South Wales. Length 20 inches.

369c. T. AEROSTATICUS. BALLOON-FISH. *Id.* Jenyns, Zool. Beagle iii., 1842, p. 152. *Crayracion lineatus* Bleeker, Atlas Ichth. v., 1865, p. 70, pl. 212, 1. *T. amabilis* Castlenau, P.L.S. N.S.W. iii., 1879, p. 401.

A tropical species, of which young specimens occasionally stray southward to Port Jackson. *T. amabilis* Castlenau, was described from a specimen 4½ inches long from Port Jackson in 1879, since which time the species has not been recognised. A local example of similar size is in the Australian Museum which, while agreeing well with Bleeker's figure quoted above, presents sufficient of the characters described by Castlenau as to leave little doubt that *amabilis* is synonymous with *aerostaticus*.

369d. T. ARMILLA. *Id.* Waite & McCulloch, Tr. Roy. Soc. S. Austr. xxxix., 1915, p. 475, pl. 15.

A southern species from deep water which is sometimes taken by trawlers. Length 8 inches.

- 369e. *T. NIGROPUNCTATUS*, var *CITRINELLUS*. *Id.* Gunther, Brit. Mus. Cat. Fish. viii., 1870, p. 293. *T. aurantius* Ogilby, Rec. Austr. Mus. i. 4, 1890, p. 80.

The type of *T. aurantius* is badly stuffed, but leaves little doubt that it is referable to the orange-coloured form of *T. nigropunctatus*. It is the only example of the species known from New South Wales, and was doubtless a straggler from the tropics. Length 11 inches.

- 369f. *T. FIRMAMENTUM*. STARRY TOADO. *Id.* Schlegel, Faun. Japonica Pisces, 1850, p. 280, pl. 126, 2 (Pl. xliii.).

A rare species, occurring in deeper water. Length 16 inches.

370. *SPHEROIDES* Dumeril, Zool. Analytique, 1806, p. 342 (*tuberculatus*).

A. Gill-opening without a cartilaginous spur projecting beyond the margin.

B. Dorsal and anal fins pointed, their posterior rays less than half as long as the third.

C. Back entirely smooth; 11-12 dorsal rays. *inermis* (370a).

CC. Back with more or less numerous spinules.

D. Caudal peduncle wider than deep immediately behind dorsal fin; 10-12 dorsal rays. *sceleratus* (370b).

DD. Caudal peduncle deeper than wide immediately behind dorsal fin; 12 dorsal rays. *spadiceus* (370c).

BB. Dorsal and anal fins subquadangular or rounded, the posterior rays more than half as long as the third.

E. Back without dark spots, but with cross-bands.

F. Nape with small spines.

oblongus (370d).

FF. Nape without spines.

pleurostictus (370e).

EE. Back with numerous dark spots; dark cross-bars usually present.

hamiltoni (370f).

AA. A cartilaginous spur projecting backward beyond margin of lower half of gill-opening; a dark stripe along each side, back with light spots.

pleurogramma (370g).

- 370a. *S. INERMIS*. SMOOTH TOADO. *Tetrodon inermis* Schlegel, Faun. Japonica Pisces, 1850, p. 278, pl. 122, 2.

A smooth silvery fish, which, like all others of the genus, is said to be poisonous if eaten. Length 18 inches.

- 370b. *S. SCELERATUS*. GIANT TOADO. *Tetrodon sceleratus* Gmelin, Syst. Nat. ii., 1789, p. 1444. *T. argenteus* Bleeker, Atlas Ichth. v., 1865, p. 64, pl. 209, 1 (Pl. xliii.).

A widely distributed species extending southward to Port Jackson. Length 30 inches.

- 370c. *S. SPADICEUS*. SILVER TOADO. *Tetrodon spadiceus* Richardson, Voy. Sulphur, Ichth., 1844, p. 123, pl. 58, 4-5.

Occurs in deep water and is often taken by trawlers. Length about 12 inches.

- 370d. *S. OBLONGUS*. *Tetrodon oblongus* Bloch, Ausl. Fische ii., 1786, p. 6; *Id.* Bleeker, Atlas Ichth. v., 1865, p. 62, pl. 208, 4.

Taken in deep water by trawlers. Length 15 inches.

- 370e. *S. PLEUROSTICTUS*. BANDED TOADO. *Tetrodon pleurostictus* Gunther, P. Zool. Soc. 1871, p. 674, pl. 69, a.

Common in the estuaries of northern rivers. Length 6 inches.

- 370f. *S. HAMILTONI*. COMMON TOADO. *Tetrodon hamiltoni* Richardson, Ichth. Erebus & Terror, 1846, p. 63, pl. 39, 10-11 (Pl. xliii.).

Very common in all shallow waters along the coast. Length 5½ inches.

370g. S. PLEUROGRAMMA. *Tetrodon pleurogramma* Regan, P. Zool. Soc. 1902, ii., 1903, p. 300, pl. 24, 2.

Not uncommon. Length 7 inches.

McCulloch and Waite, Tr. Roy. Soc. S. Aust. xl., 1916, p. 450, have united this species with *S. altipinnis* Ogilby, but this is apparently incorrect.

The specimen recorded as *Tetrodon erythrotaenia* from Sydney by Kner, Novara Zool. i., 1867, p. 408, was perhaps referable to *S. pleurogramma*.

S. richiei Fremenville, has been recorded from Sydney by Kner, Novara Zool. i., 1867, p. 407. Though common in Southern Australia, there is no evidence that it occurs in New South Wales waters.

CLXI.

Family DIODONTIDAE.

A. All the spines with two roots and movable.

Diodon (371).

AA. Most of the spines fixed, with 3 roots.

B. Anterior spines 2-rooted and movable; about 12 dorsal and anal rays.

Dicotylichthys (372).

BB. Anterior spines 3-rooted; 15-16 dorsal and anal rays. *Allomycterus* (373).

371. DIODON Linne, Syst. Nat. 10th. ed., 1758, p. 334 (*hystrix*).

371a. D. HOLOCANTHUS. *Id.* Linne, *Ibid.*, p. 335. *Paradiodon quadrimaculatus* Bleeker, Atlas Ichth. v., 1865, p. 58, pl. 212, 2.

A tropical species of which the young sometimes wander southward into New South Wales. Length 12 inches.

D. hystrix Linne, was included in a mere list of Port Jackson fishes by Castlenau, P.L.S. N.S.W. iii., 1879, p. 357. As it has not been since recognised from these waters, further proof of its occurrence is necessary.

372. DICOTYLICHTHYS Kaup, Arch. Naturg. xxi., 1855, p. 230 (*punctulatus*).

372a. D. PUNCTULATUS. PORCUPINE-FISH. *Id.* Kaup, *Ibid.*; *Id.* Waite, Mem. Austr. Mus. iv. i., 1899, p. 98, pl. 19 (Pl. xliii.).

Very common in estuaries and inlets along the coast. Length 12 inches.

373. ALLOMYCTERUS McCulloch, Rec. Austr. Mus. xiii. 4, 1921, p. 141 (*jaculiferus*).

373a. A. JACULIFERUS. PORCUPINE-FISH. *Diodon jaculiferus* Cuvier, Mem. Mus. Hist. Nat. iv., 1818, p. 130, pl. 7. *A. jaculiferus* McCulloch, Rec. Austr. Mus. xiii. 4, 1921, p. 141, pl. 33, 2.

Commonly taken by trawlers in moderately deep water. Length 12 inches.

CLXII.

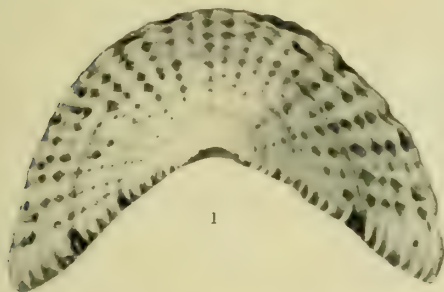
Family MOLIDAE.

374. MOLA Koelreuter, Novi Comm. Act. Petropol. viii., 1770, p. 337 (*aculeata*).

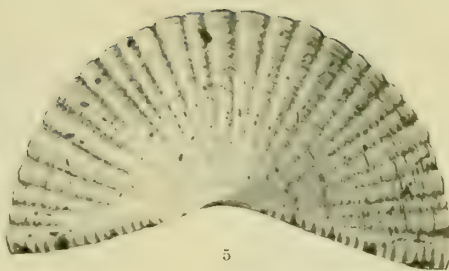
374a. M. MOLA. SUN-FISH. *Tetrodon mola* Linne, Syst. Nat. 10th. ed., 1758, p. 334. *Orthogoriscus mola* Schlegel, Faun. Japonica, Pisces, 1850, p. 288, pl. 127 (Pl. xliii.).

Apparently not rare off the coast, and occasionally stranded on ocean beaches. Length 10 feet.

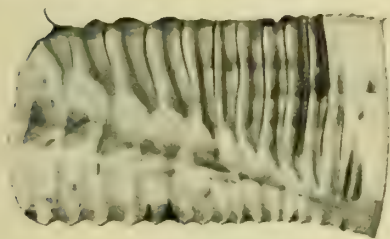




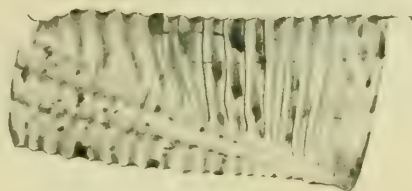
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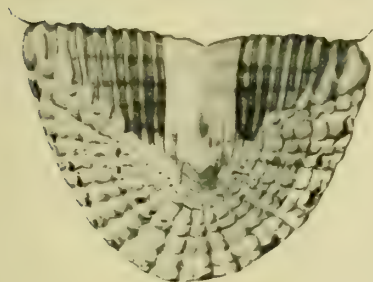
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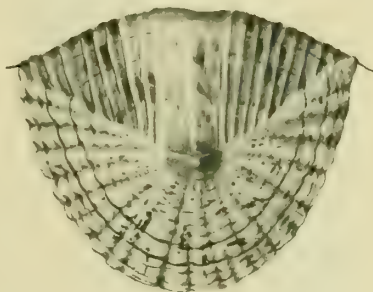
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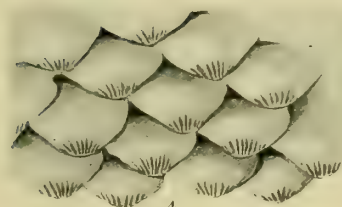
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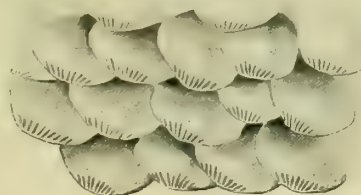
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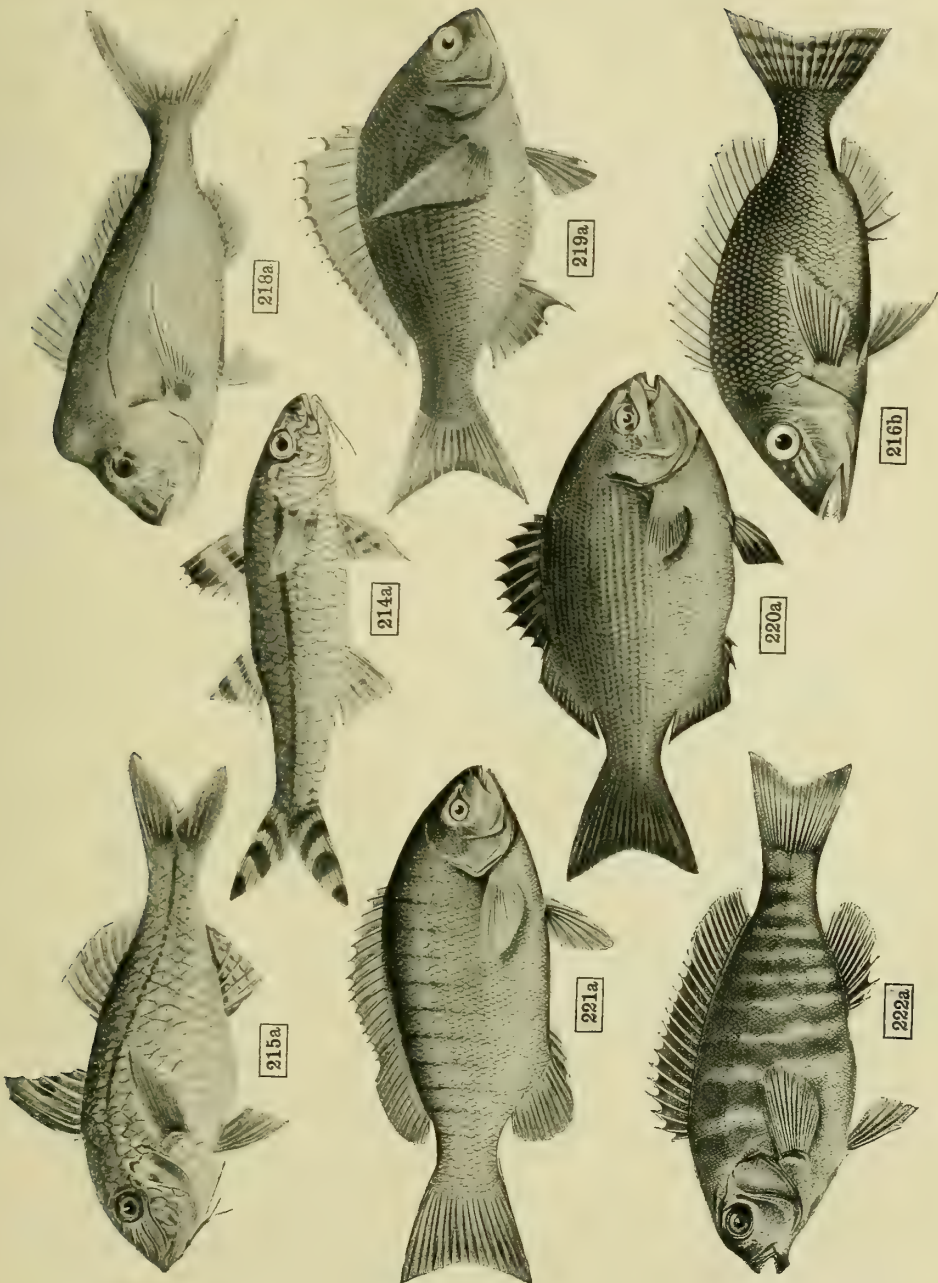


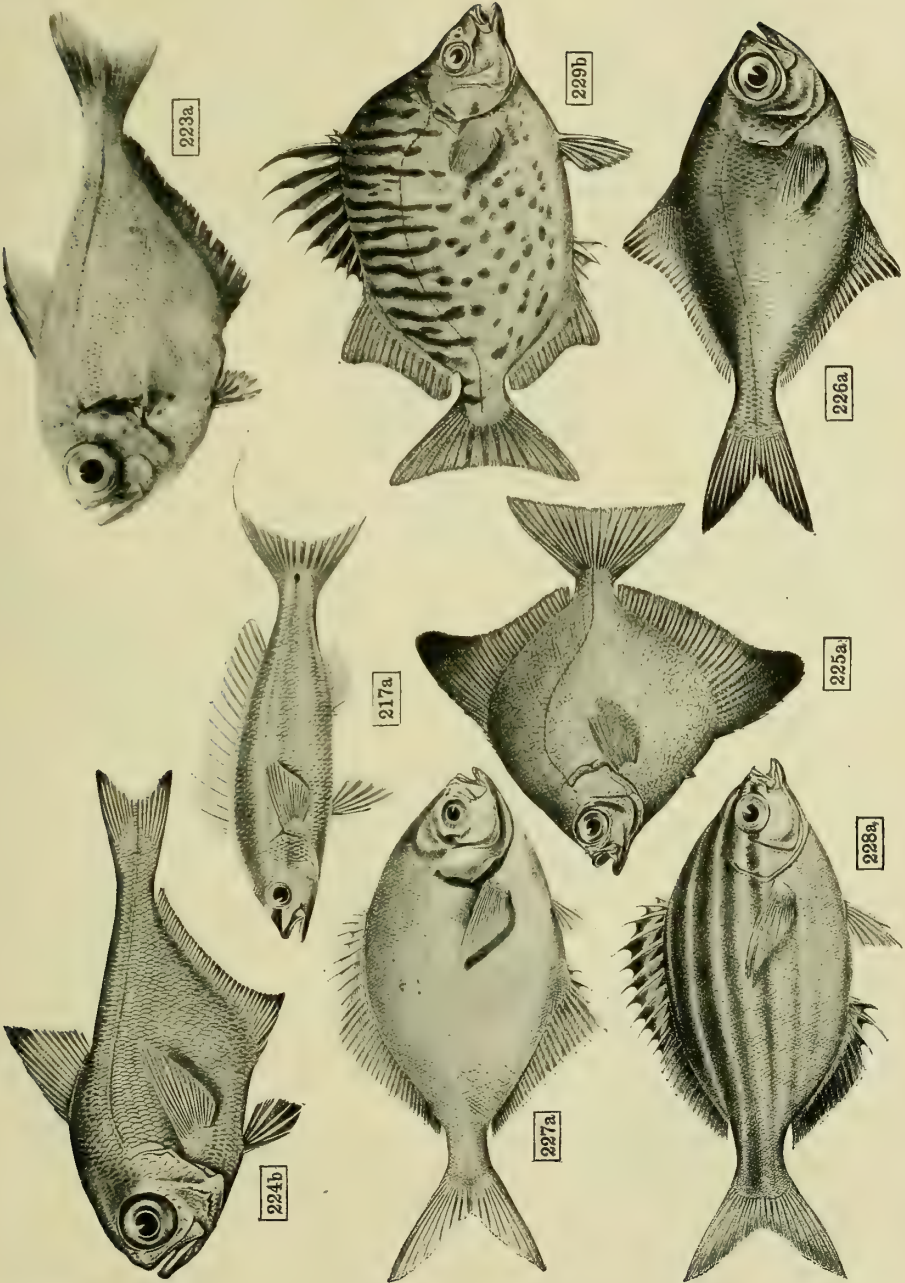
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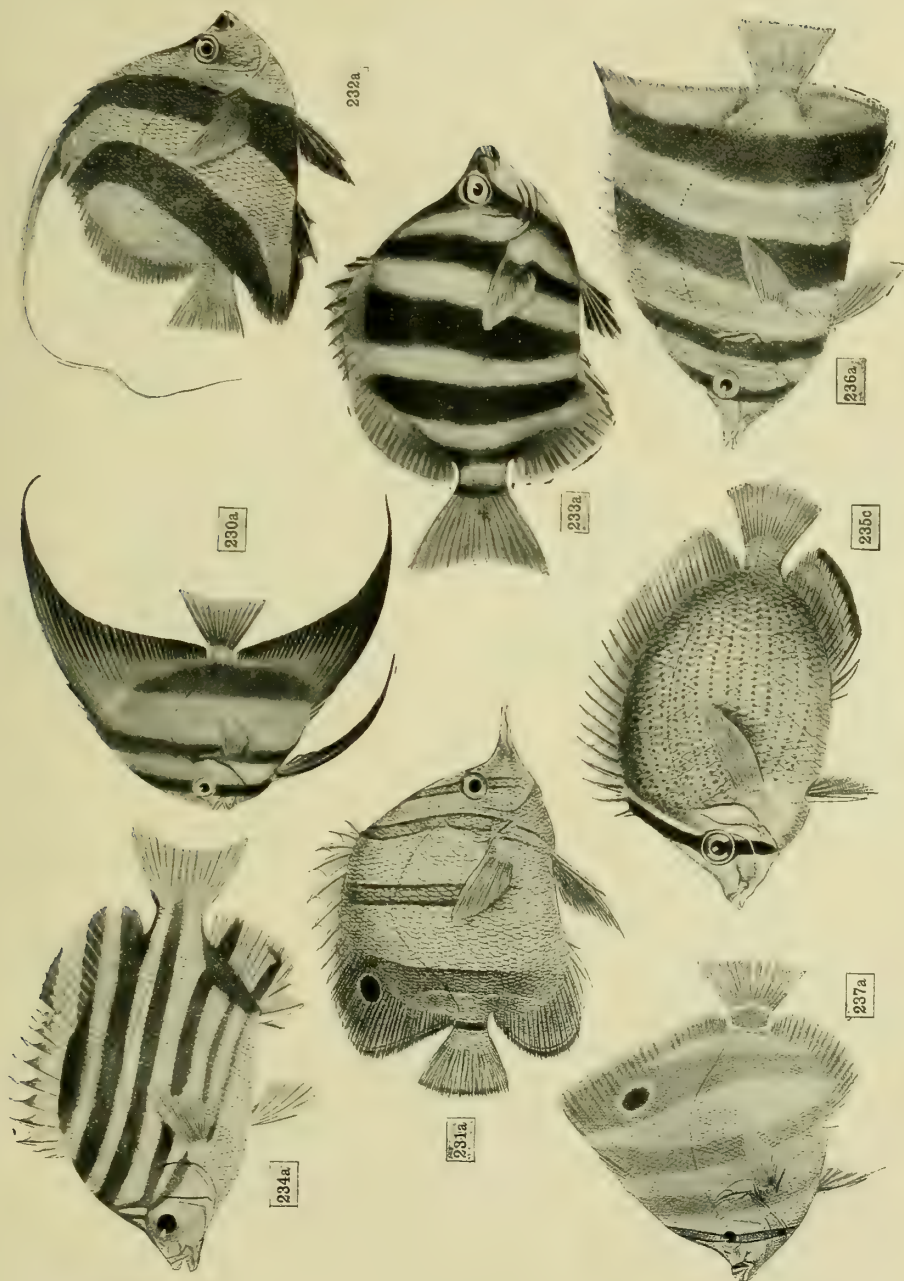


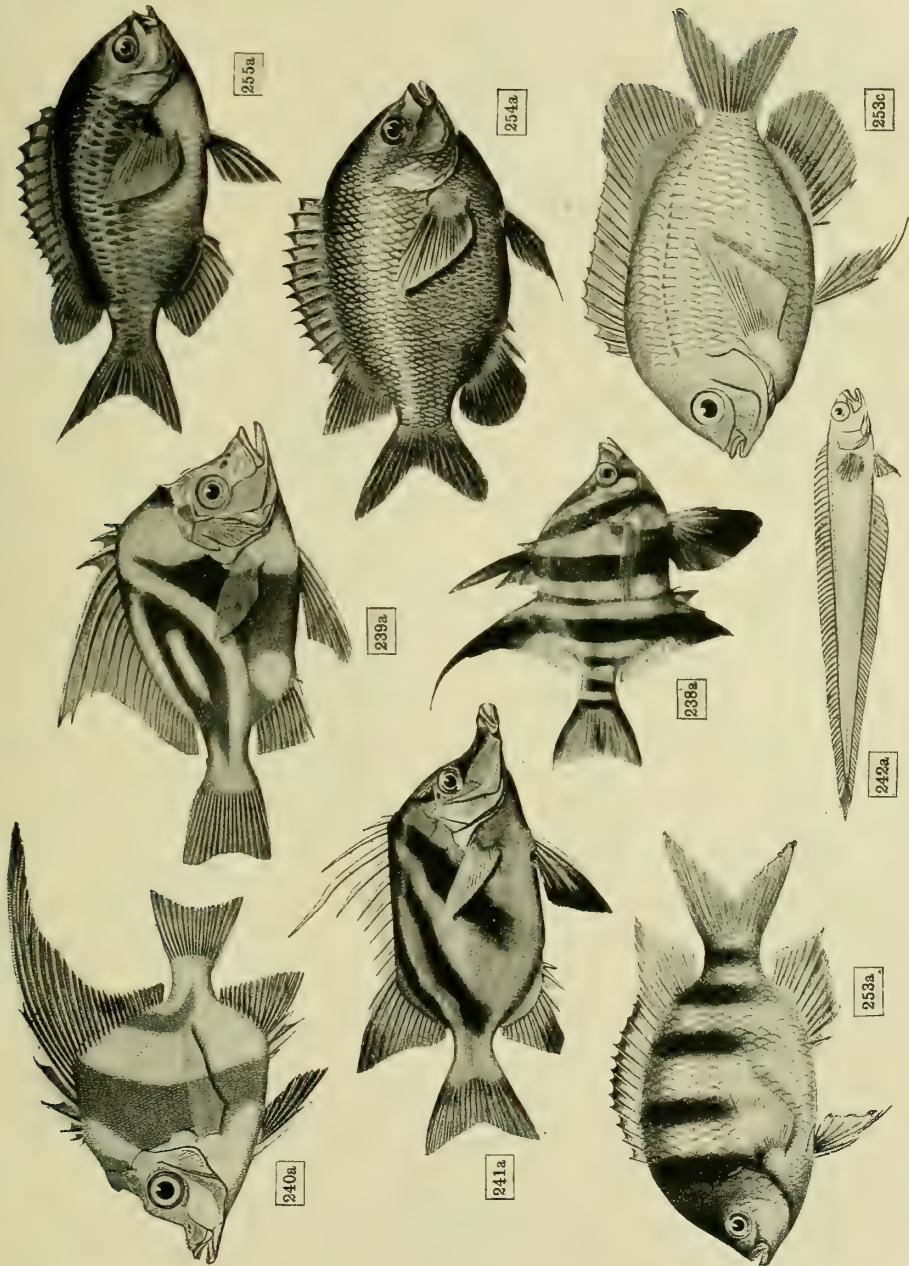
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PHYLLIS CLARK, del.

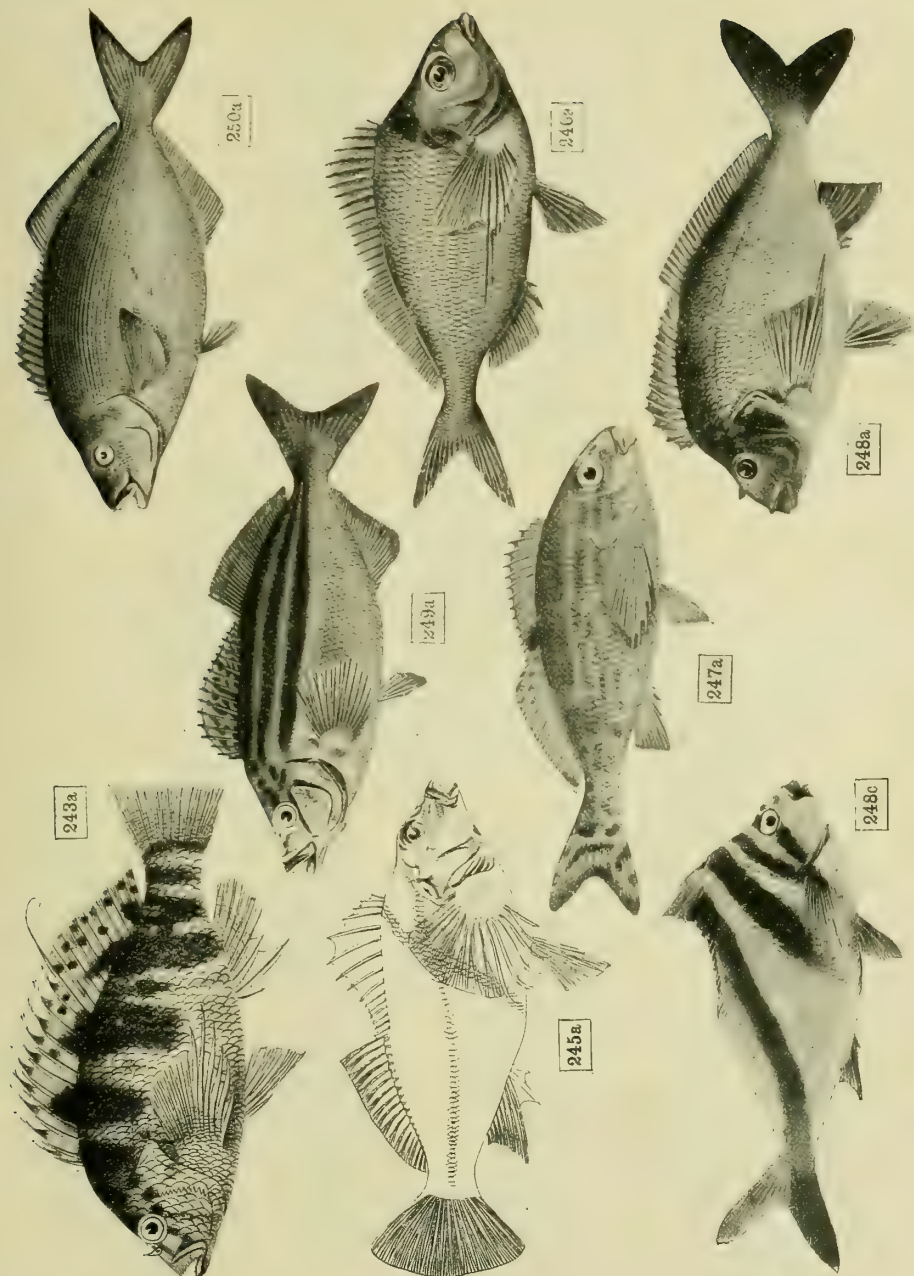


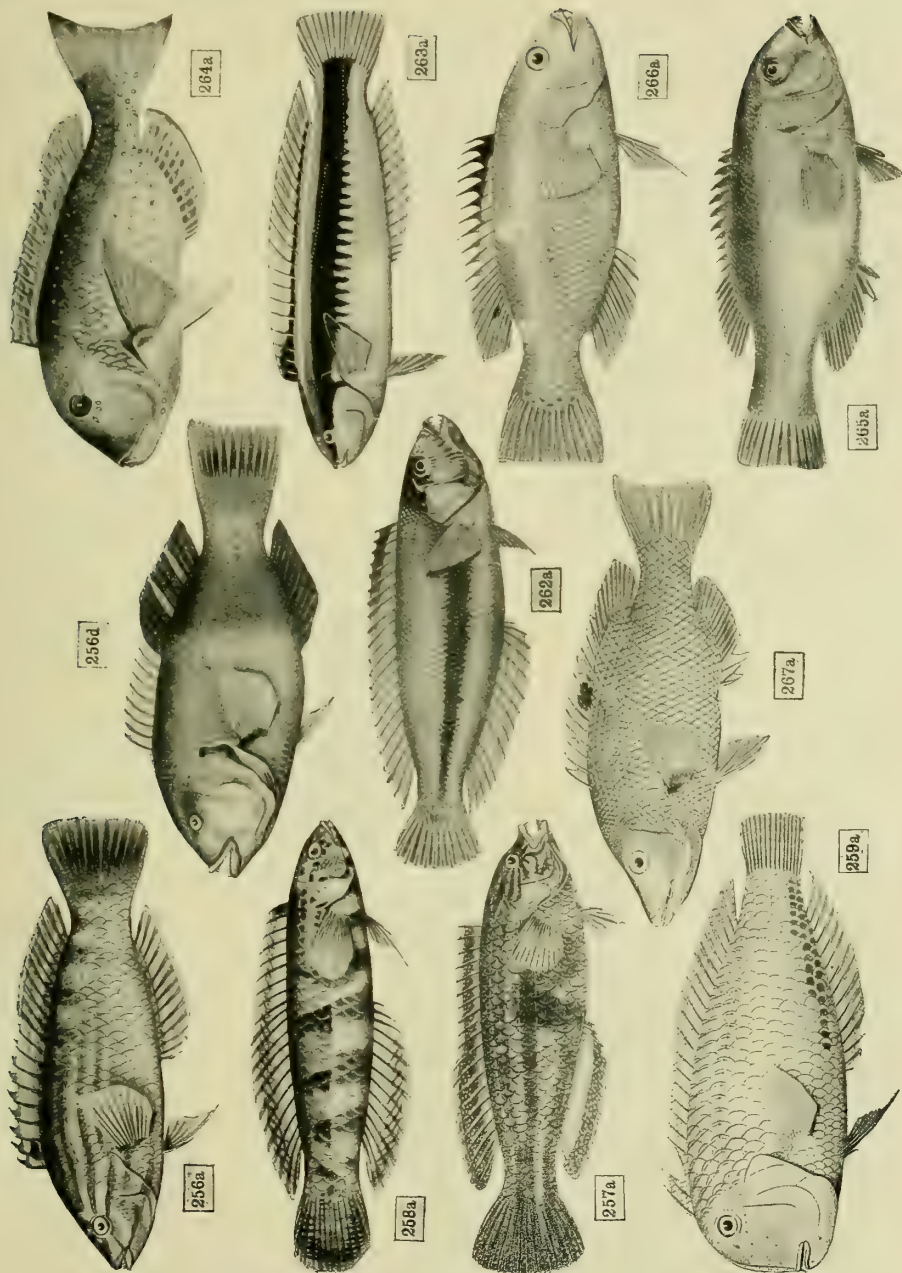


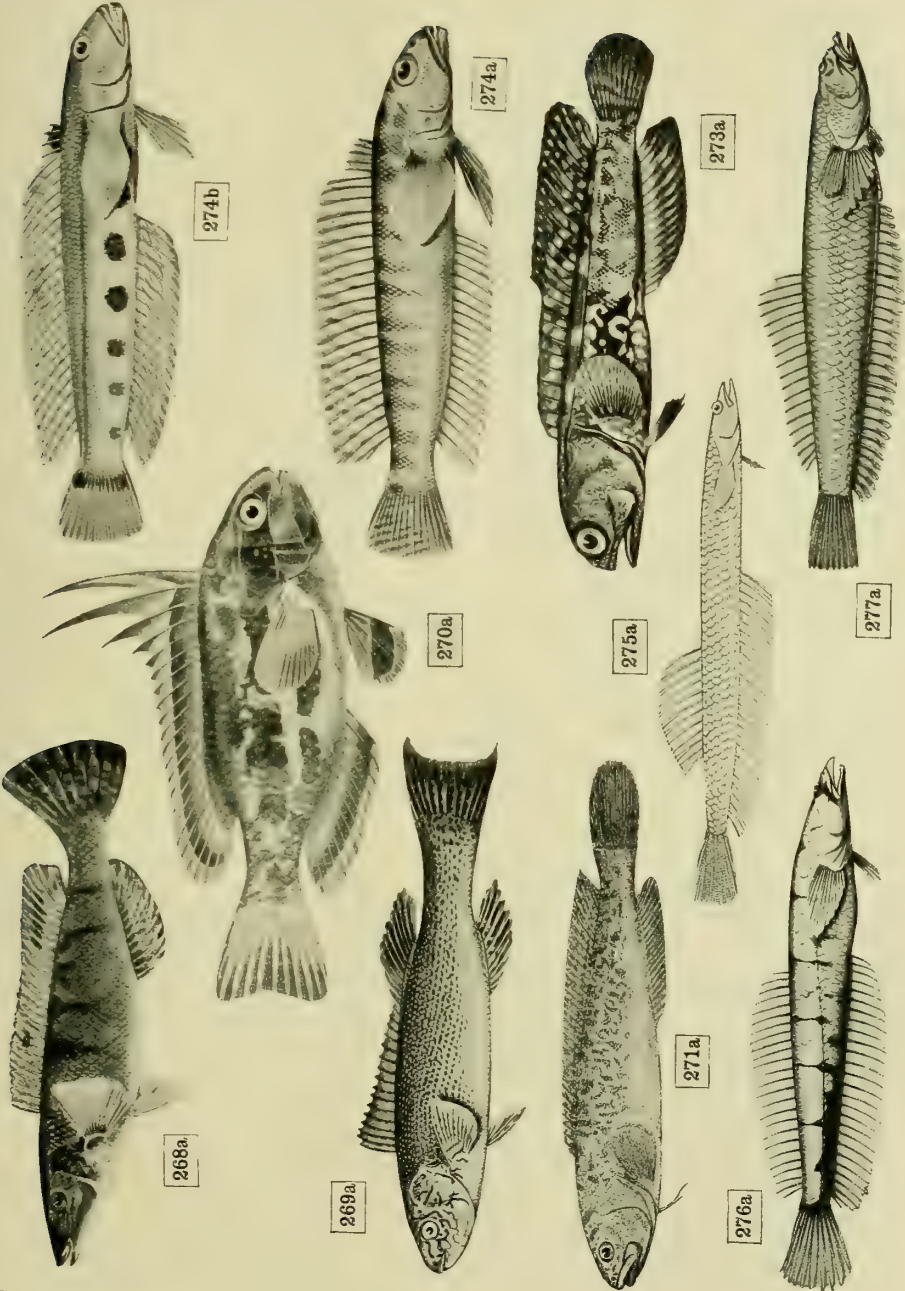


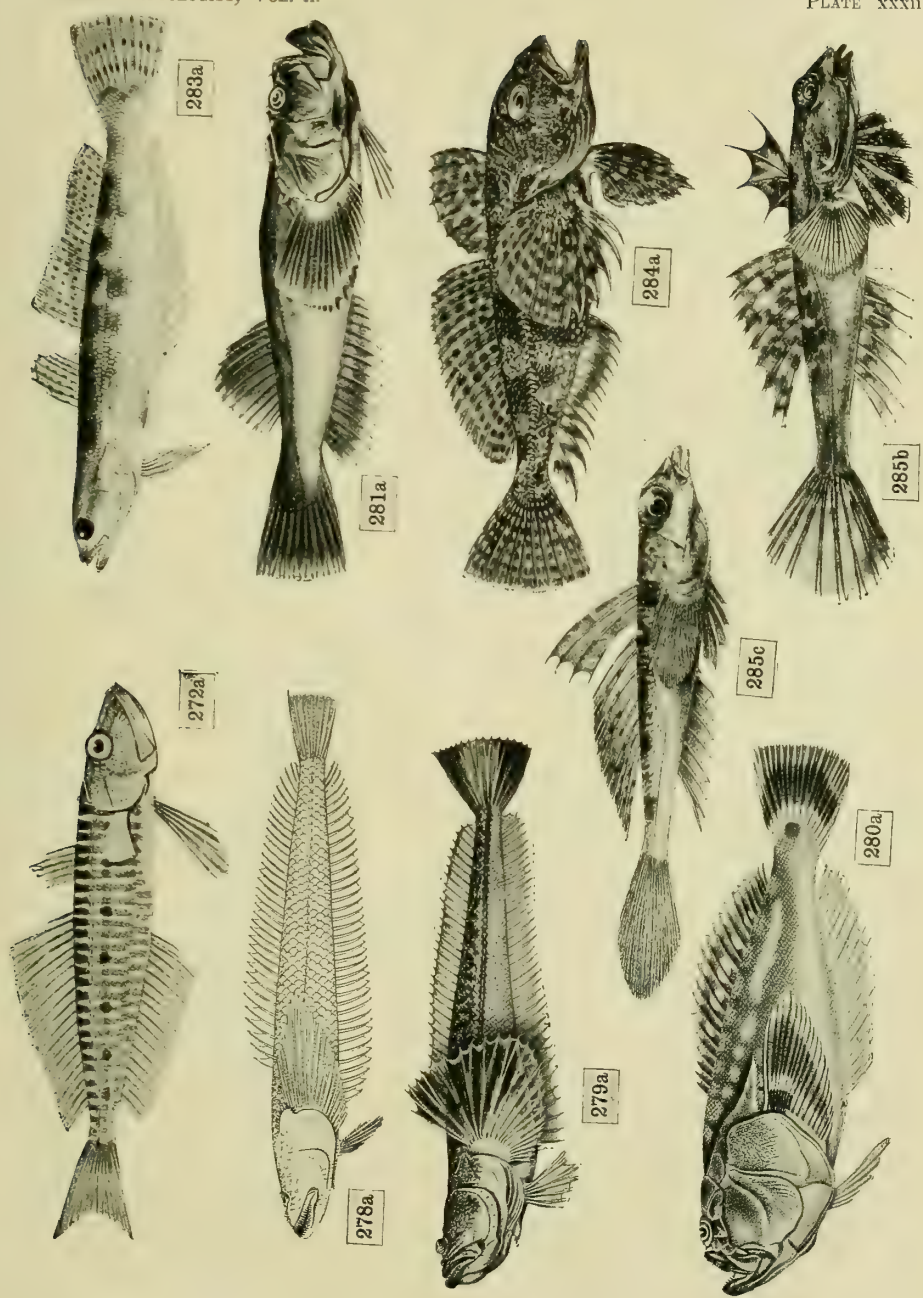


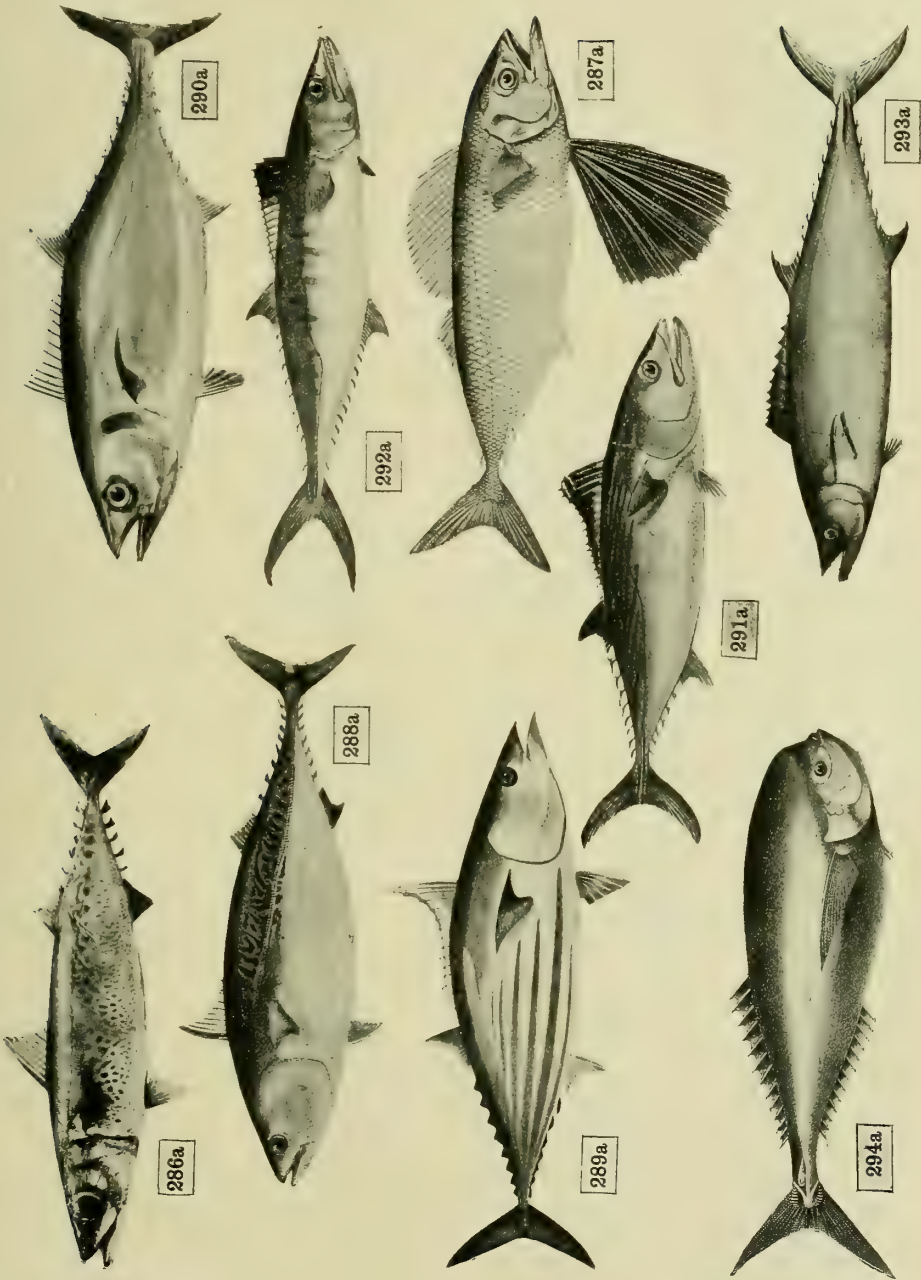
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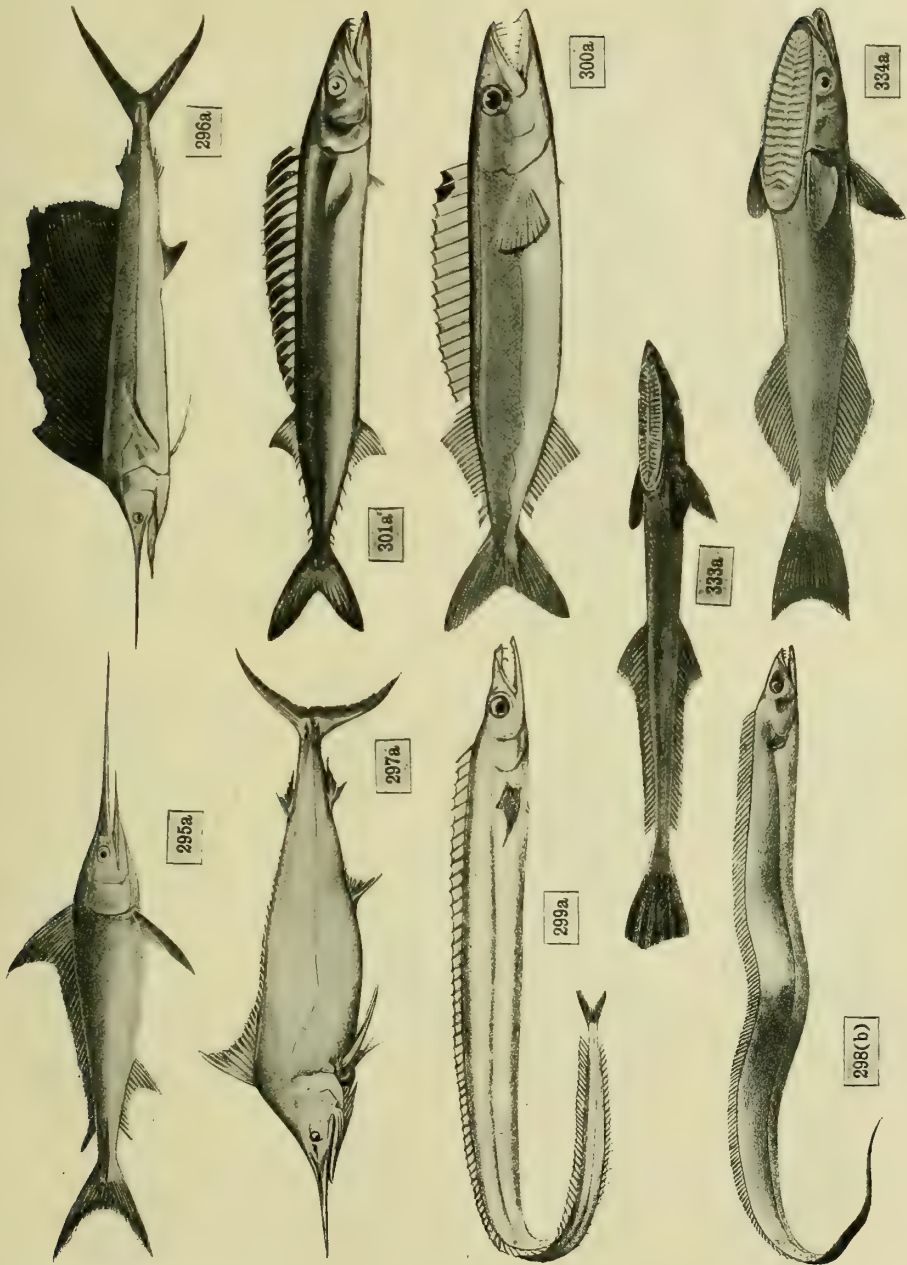


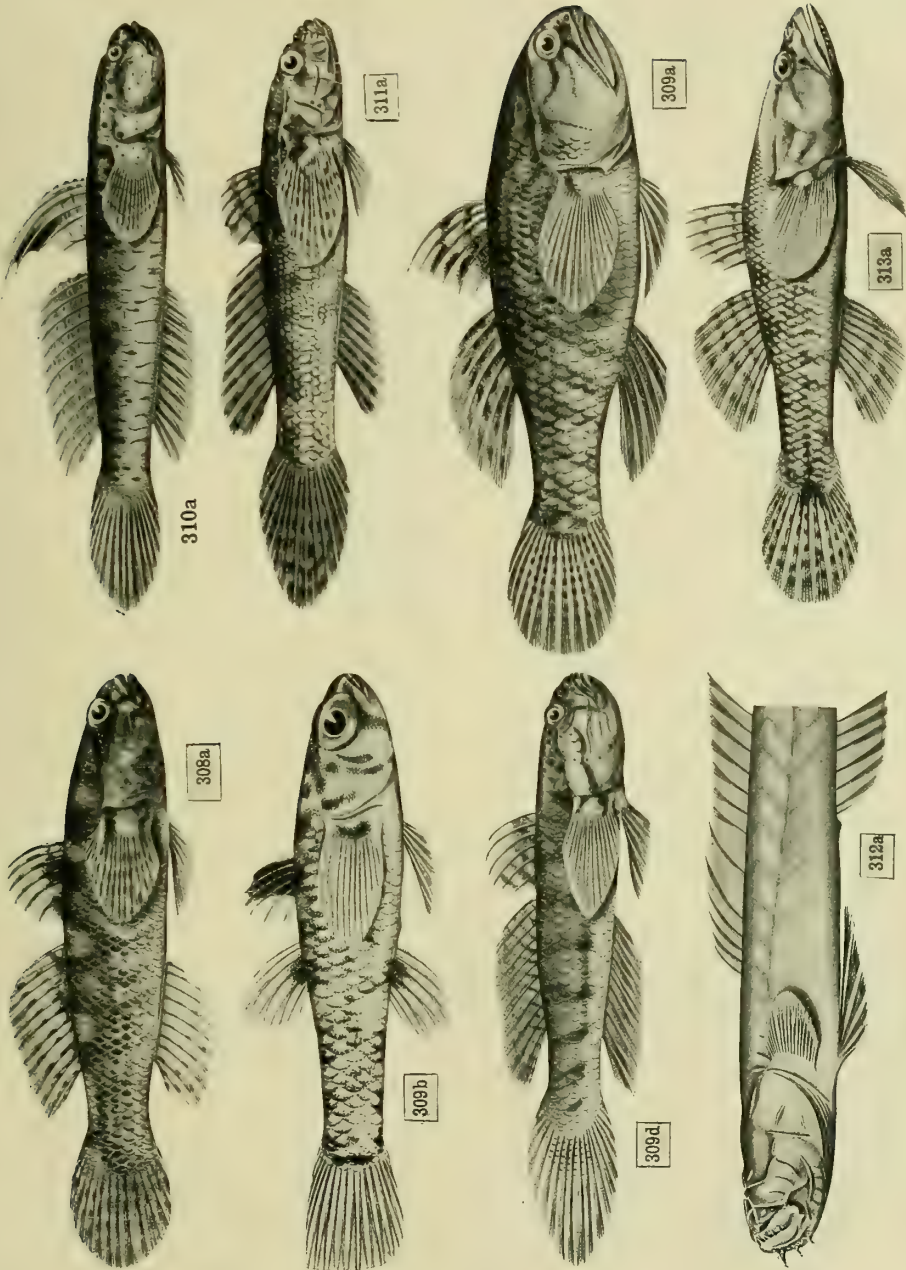




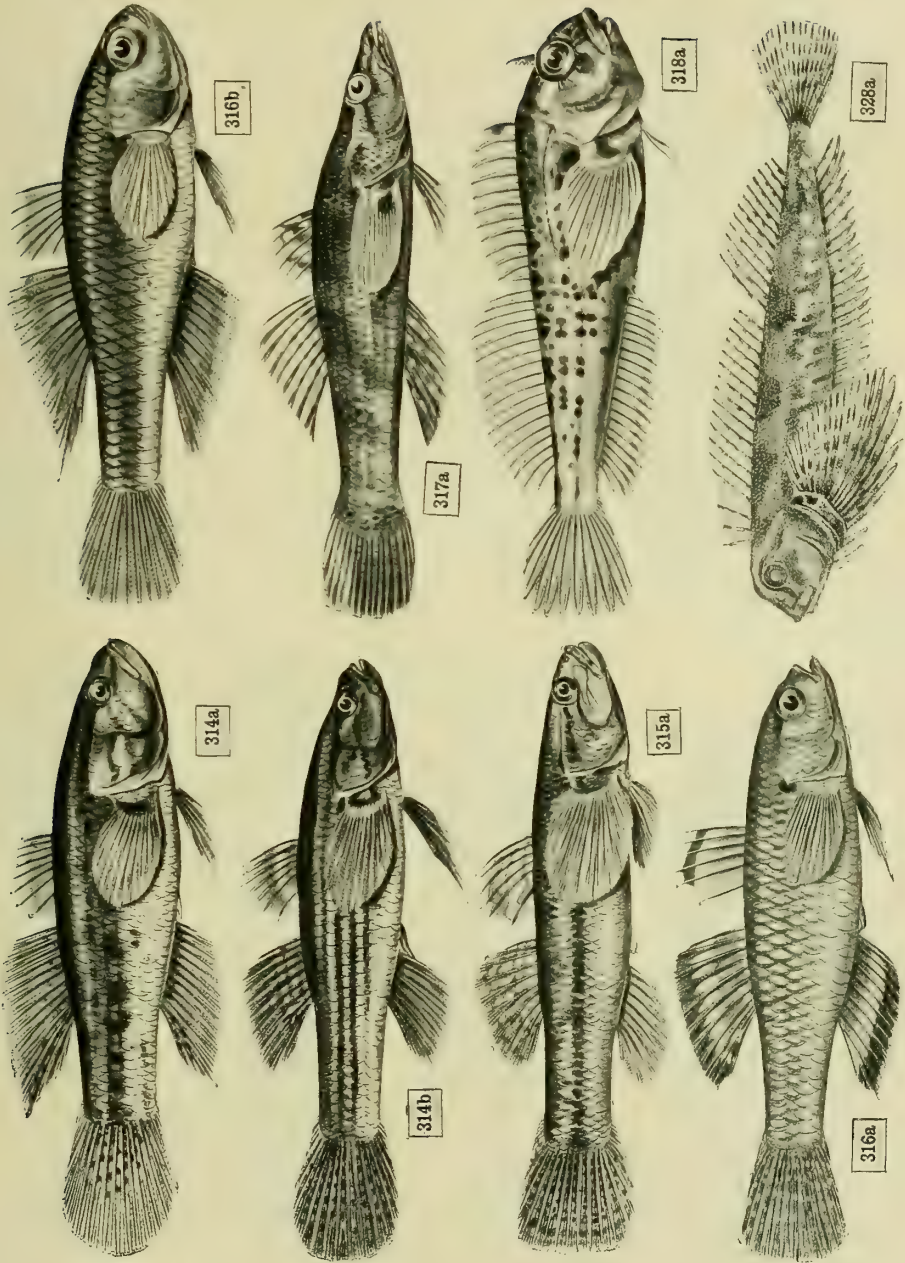




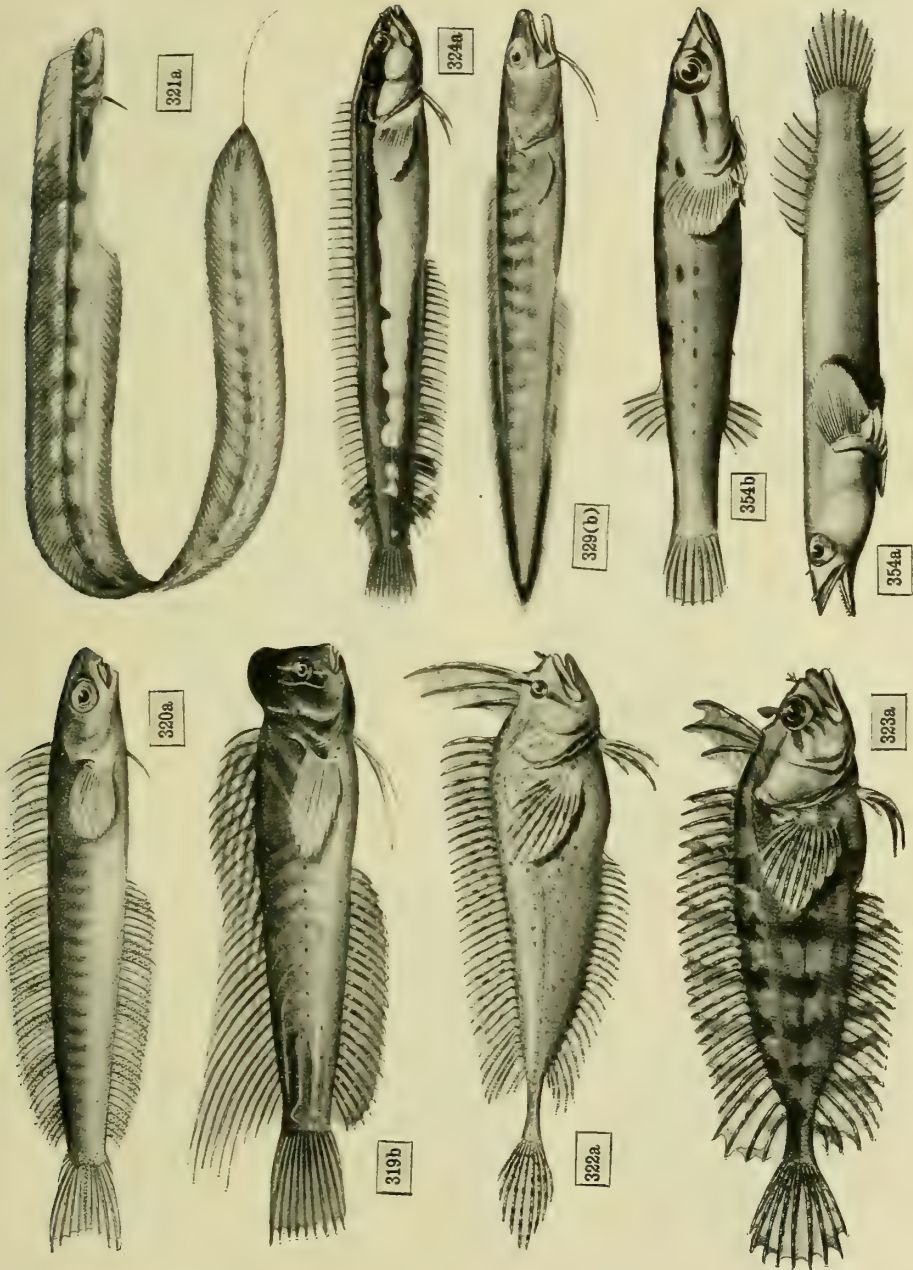




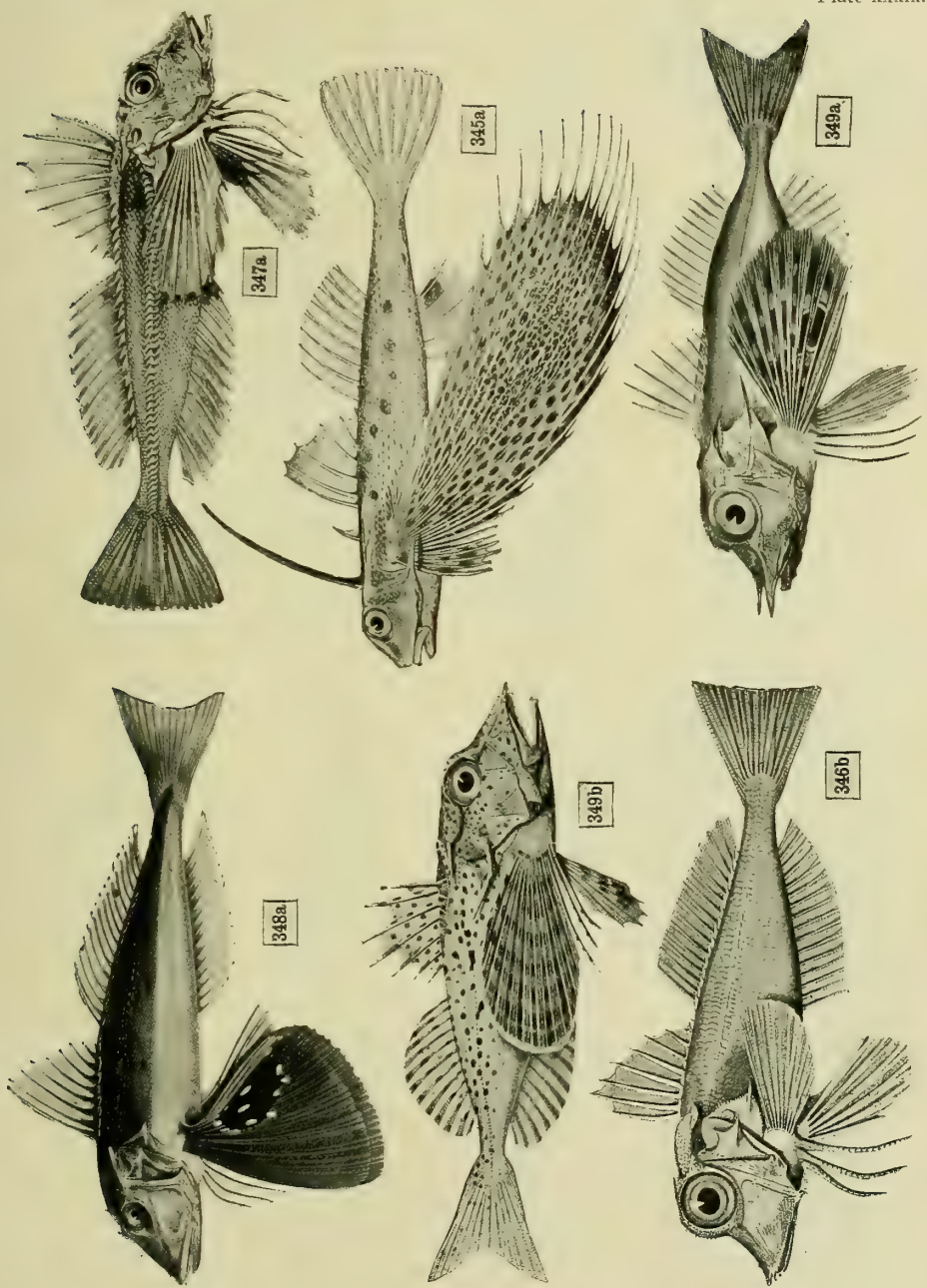
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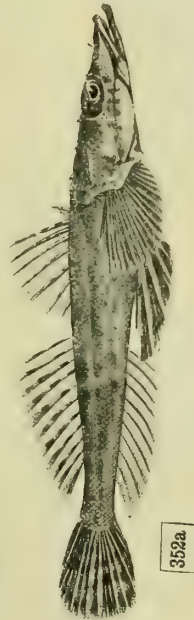
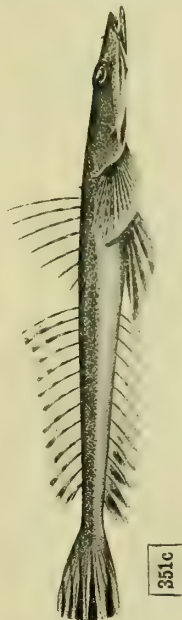
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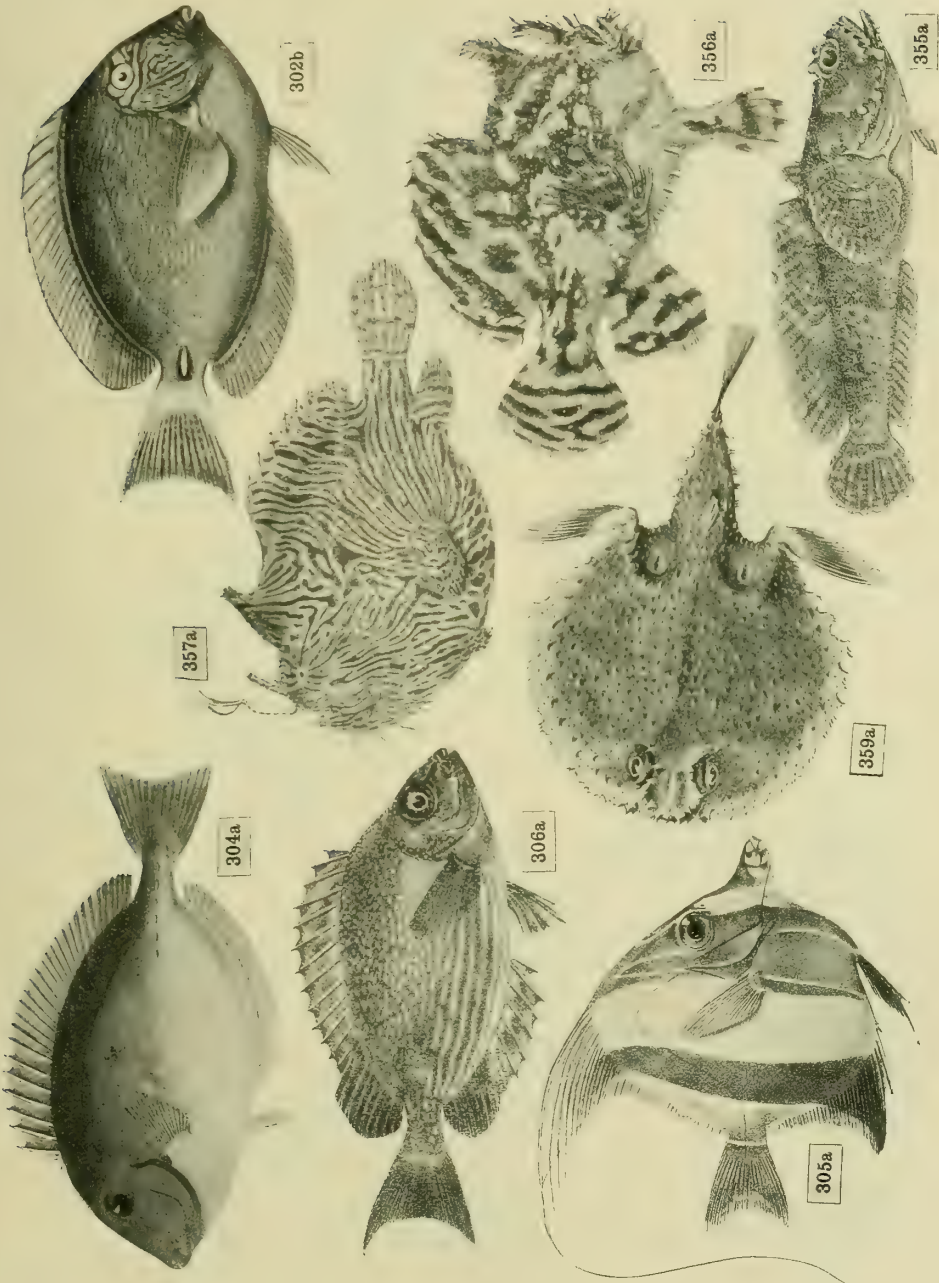


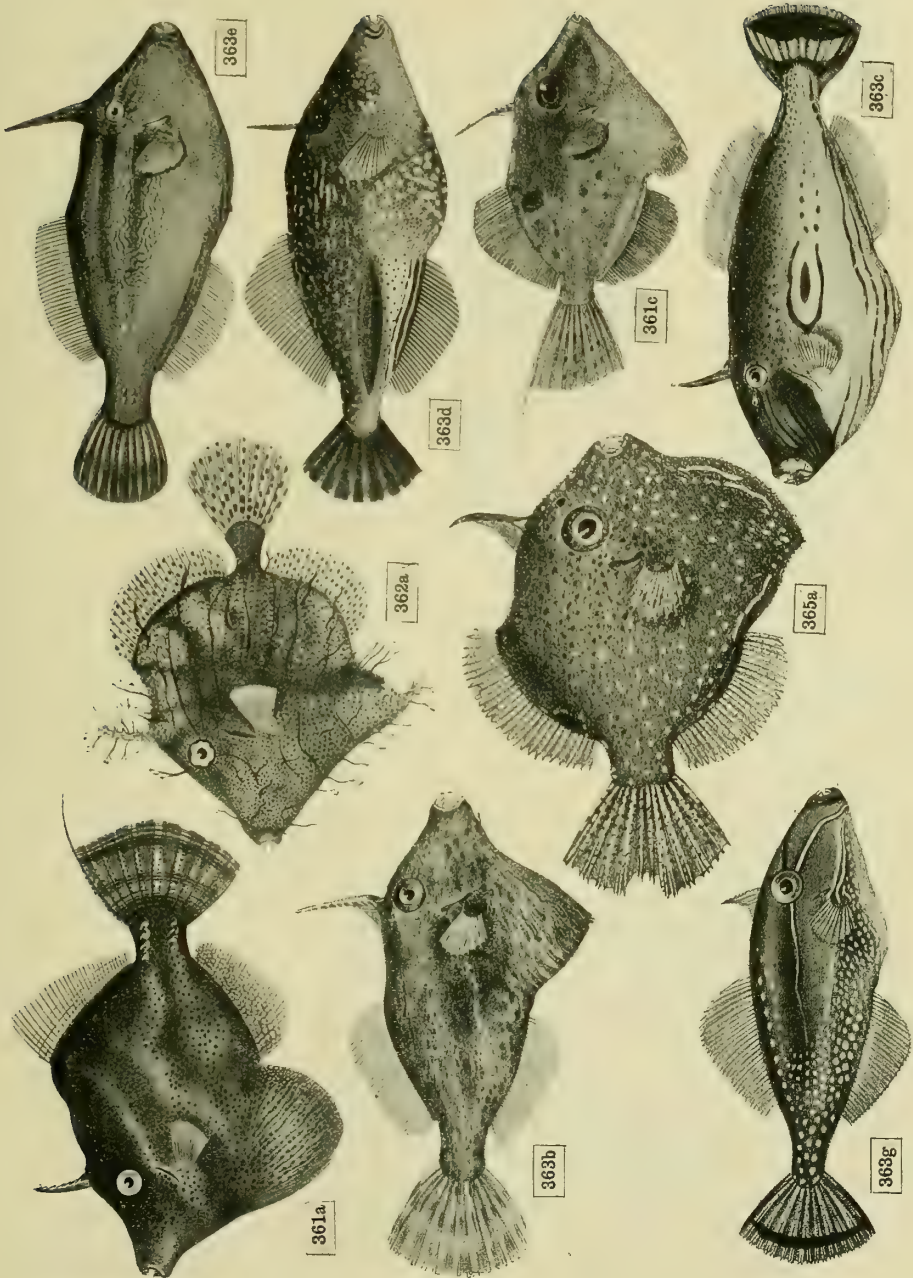


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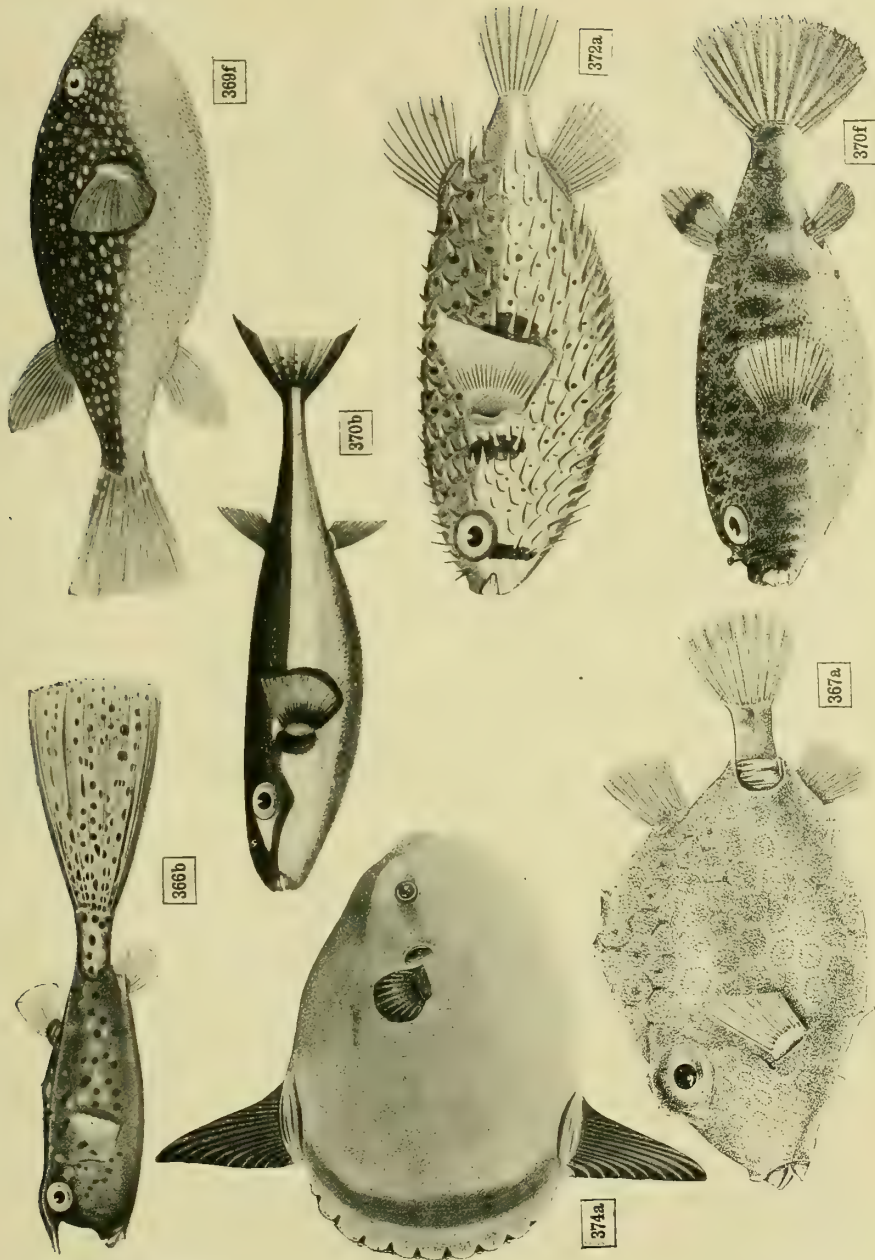


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Edited by
LAUNCELOT HARRISON, B.Sc., B.A.,
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And A. F. BASSET HULL, C.F.A.O.U.

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Royal Zoological Society of New South Wales.

ALTERATION OF ARTICLES OF ASSOCIATION.

At a General Meeting of the Society, held on 8th March, 1922, it was resolved that Article 9 of the Articles of Association be amended as follows:—After the word “shilling” in line 3, insert “and every person admitted as an ordinary member on or after the first day of July, 1922, shall pay an entrance fee of one pound one shilling.” At the end of the Article, add “The Council shall have power to remove from the Register of Members the name of any ordinary or associate member whose subscription is more than twelve months in arrear.”

It was further resolved that Article 10 of the Articles of Association be amended as follows:—Omit “an ordinary” in line 4, insert “any ordinary or associate.”

The Articles as altered now read:—

9. Until otherwise determined by an ordinary resolution of a General Meeting every ordinary member of the Society shall pay an annual subscription of one pound one shilling, and every person admitted as an ordinary member on or after the first day of July, 1922, shall pay an entrance fee of one pound one shilling; and every associate member of the Society shall pay an annual subscription of seven shillings and sixpence. Such subscriptions shall be payable on admission and thereafter on the first day of July in each year. Provided that any ordinary or associate member admitted between the first day of January and the thirtieth day of June in any year shall be required to pay one-half of the annual subscription only for that year. The Council shall have power to remove from the Register of Members the name of any ordinary or associate member whose subscription is more than twelve months in arrear.

10. The Council shall have power until otherwise determined by ordinary resolution of a General Meeting to accept the amount of ten annual subscriptions at any time in one sum from any ordinary or associate member as a life composition for the annual subscription: Provided that any ordinary member of the unincorporated Society who had compounded his annual subscription under the Rules of the said unincorporated Society and who shall become a member of the Society shall not be required to make any further payment.

REASONS FOR THE ALTERATIONS.

It will be remembered that under the arrangement with the Taronga Park Trust, the number of members of the Society to whom passes and extra tickets of admission to the Park are granted was limited to 300, one guinea being payable to the Trust in respect of each in excess of that number. As the Register

of ordinary members now contains over 300 names, it will entail an actual loss to the Society to accept further nominations without some additional payment. Hence the entrance fee.

The provision for removal of the names of members who are unfinancial is a rectification of an omission, and the power to commute an associate member's subscription brings that class into line with the ordinary members.

ADVANTAGES OF LIFE-MEMBERSHIP.

The payment of an amount equal to ten annual subscriptions ensures to the member all the advantages and privileges of membership for the rest of his life. No annual reminders that the subscription is due are necessary, and from a financial point of view the investment is generally a satisfactory one—some of the present life members commuted twenty years ago!

From the Society's point of view, the commutation fee, which is immediately capitalised, becomes a permanent asset, and the postages and clerical work of sending out notices are saved.

The earnest consideration of members is invited to the advantages of commuting.

VALIDITY OF PASSES AND TICKETS.

While the number of ordinary members was less than the complement, no restrictions were placed upon the use of tickets even after the year for which they were issued had expired. Now that the complement has been reached, passes and extra tickets will be available only for the year in which they are issued. As a special concession, however, the Taronga Park Trust has agreed to accept tickets issued during the current financial year up to the 31st July next, after which date they will not be recognised.

Members are therefore earnestly requested to use their current year's tickets within the time allowed, or to destroy them if not used by the 31st July. It will also be a great convenience to the Society, and incidentally save themselves some possible inconvenience, if ordinary members, other than life members, will remit their subscriptions for 1922-3 to the Hon. Secretary, before the end of June.

GENERAL MEETINGS.

The third of the General Meetings under the new scheme was held at the Society's Room on Wednesday, 8th March, 1922, the attendance being disappointingly small. Mr. Basset Hull exhibited a collection of Chitons (Polyplacophora) taken by him during a recent visit to South Western Australia. Mr. H. J. Carter exhibited five genera of Australian Buprestidae, not yet recorded. Two of these were new genera—*Neraldus* Thery and *Cyrioides* Carter. The other genera, *Melanophila*, *Diceropygus*, and *Endelus*, have so far been recorded from Malaysia (*Melanophila* from other regions also). *Endelus* is curious for its small size and divided head. Mr. E. F. Pollock exhibited a number of photographs taken by himself at Taronga Park. Mr. A. Musgrave exhibited insects collected on the Nullarbor Plain and in the Recherche Archipelago. Mr. A. S. Le Souef gave a short description of some Museum improvements he had seen in America.

ANIMAL PHOTOGRAPHY.

The Photographic Society of New South Wales has kindly invited members of this Society to a lecture on Animal Photography by Mr. E. F. Pollock on 19th September next at the Assembly Hall, Department of Education, Sydney, at 8 p.m.

NEW MEMBERS.

The following members have been elected since the publication of Part 3:—

Ordinary:—Dr. C. Anderson, G. Corlet, H. Goodwin, Anthony Hordern, E. B. Hill, Dr. G. Hurst, Miss A. Hordern, Miss D. Hordern, T. A. Miller, J. McCarthy, F. A. Perkins, Dr. Cecil Purser, W. Scott, Miss M. L. B. Scott, E. S. Sorenson.

Associate:—J. C. B. Allen, W. M. Brennan, E. A. Briggs, C. W. Chisholm, Dr. E. C. Chisholm, Dr. A. Chenery, D. Dalton, F. A. Gilbert, J. Hislop, J. Mann, R. L. T. Macmeikan, Dr. J. MacPherson, K. C. McKeown, W. R. B. Oliver, G. H. Wylde, H. Wolstenholme.

ORNITHOLOGICAL SECTION.

This Section has been established, the inaugural meeting being held on the 21st April, 1922. The officers are:—Dr. E. A. D'Ombain, Chairman, Mr. Percy A. Gilbert, vice-Chairman, and Mr. Neville W. Cayley, Hon. Secretary. The meetings are to be held on the third Friday in the months of February, April, June, August, October, and December. Communications may be addressed to the Hon. Secretary, Box 2399, G.P.O., Sydney. A permanent camp for bird observation is amongst the proposed activities of the Section.

The Royal Australasian Ornithologists' Union, which has its headquarters in Melbourne, has agreed to the affiliation of its New South Wales members with the Society. The local branch of the Union will, when necessary, meet and transact its business at the Society's office. Members of the Union not already members of the Society are cordially invited to attend the Sectional meetings.

THE FIRST HANDBOOK.

Mr. A. R. McCulloch's Check List of the Fishes of New South Wales is now ready for issue in book form as the first of the Society's Handbooks. Copies may be obtained from the Honorary Secretary, or may be ordered from Angus and Robertson, Limited, Castlereagh Street, Sydney. The price is five shillings.

HISTORICAL NOTES ON THE PLATYPUS.

By Launcelot Harrison, B.Sc., B.A.

(Zoology Department, University of Sydney.)

In searching back through the literature of a little more than a century to discover what had been written about the Platypus, a necessary labour for the purpose of a *Natural History of the Platypus* which I am preparing in collaboration with Mr. Harry Burrell, I find a history of very great interest, which has not been assembled before, and of which I feel justified in giving some immediate account.

The Platypus would seem to have been observed for the first time by the colonists of New South Wales in the year 1797. In Collins' *New South Wales*, pp. 62-3, under the date "November, 1797," there occurs the following account of what was apparently the first individual captured:—

"The Kangaroo, the Dog, the Opossum, the Flying Squirrel, the common Rat, and the large Fox-bat (if entitled to a place in this Society), made up the whole catalogue of animals that were known at this time, with the exception which must now be made of an amphibious animal, of the mole species, *one of which had been lately found on the banks of a lake near the Hawkesbury*. In size it was considerably larger than the land-mole. The eyes were very small. The fore legs, which were shorter than the hind, were observed, at the feet, to be provided with four claws, and a membrane, or web, that spread considerably beyond them, while the feet of the hind legs were furnished, not only with this membrane or web, but with four long and sharp claws, that projected as much beyond the web, as the web projected beyond the claws of the fore feet. The tail of this animal was thick, short, and very fat; but the most extraordinary circumstance observed in its structure was, its having, instead of the mouth of an animal, the upper and lower mandibles of a duck. By these it was enabled to supply itself with food, like that bird, in muddy places, or on the banks of lakes, in which its webbed feet enabled it to swim; while on shore its long and sharp claws were employed in burrowing; nature thus providing for it in its double or amphibious character. These little animals had been frequently noticed rising to the surface of the water, and blowing like a turtle."

Collins' work was not published until 1802, but was written in diary form, so that the above is probably the first *written* description of *Ornithorhynchus*, though four other descriptions have priority of publication. Except for the fact that the number of claws is wrongly given, it is a reasonably good description.

I have not been able to trace the subsequent history of this first captured individual, but in the year following its capture, this or some other specimen has come into the hands of a London dealer, a "Mr. Dobson, so much distinguished by his exquisite manner of preparing specimens of vegetable anatomy," who entrusted it to Dr. George Shaw, of the British Museum, for description.

It is noteworthy that Dr. Shaw had previously, in 1792, described the Echidna. The learned doctor proceeded somewhat gingerly to his task, having all the time an uneasy impression that he was being deceived. Chinese and Japanese taxidermists had become notorious for the skill with which they constructed non-existent animals for sale to credulous sailor-men. The most famous of these was the eastern mermaid, made of the fore-part of a monkey, and the tail of a fish, an example of which happens to be displayed at the present time in a curiosity shop at the foot of Pitt Street. It is very obvious that Shaw had these monstrosities in mind all through his early dealings with the Platypus.

He describes the animal as *Platypus anatinus* in the 10th Volume of the *Naturalist's Miscellany*, dated 1799, and gives, in Plates 385 and 386, the first published figures; the former Plate giving a view of the whole animal, and the latter, three aspects of the "bill," and the fore and hind foot.

There is no need to quote here Shaw's full description, but a couple of paragraphs are interesting, as giving evidence of the state of his mind.

"Of all the Mammalia yet known it seems the most extraordinary in its conformation; exhibiting the perfect resemblance of the beak of a Duck engrafted on the head of a quadruped. So accurate is the similitude, that, at first view, it naturally excites the idea of some deceptive preparation by artificial means; the very epidermis, proportion, serratures, manner of opening, and other particulars of the beak of a shoveler, or other broad-billed species of duck, presenting themselves to the view: nor is it without the most minute and rigid examination that we can persuade ourselves of its being the real beak or snout of a quadruped."

And again:—"On a subject so extraordinary as the present, a degree of scepticism is not only pardonable, but laudable; and I ought perhaps to acknowledge that I almost doubt the testimony of my own eyes with respect to the structure of this animal's beak; yet must confess that I can perceive no appearance of any deceptive preparation; and the edges of the rictus, the insertion, etc., when tried by the test of maceration in water so as to render every part completely moveable, seem perfectly natural; nor can the most accurate examination of expert anatomists discover any deception in this particular."

Almost two years later Shaw repeats the description in his *General Zoology* (1800, Vol. i., pp. 228-232), with the following remarks as preface:—

"Of this most extraordinary genus (*Platypus*) the first description appeared in the *Naturalist's Miscellany*; but as the individual there described was the only one which had been seen, it was impossible not to entertain some distant doubts as to the genuine nature of the animal, and to surmise, that, though in appearance perfectly natural, there might still have been practised some arts of deception in its structure. I, therefore, hesitated as to admitting it into the present History of Quadrupeds. Two more specimens, however, having been very lately sent over from New Holland, by Governor Hunter, to Sir Joseph Banks, the suspicions before mentioned are now completely dissipated."

It is clear from this that up to 1800 only three specimens had come under Shaw's notice. Whether we are justified in concluding from the words "as the individual there described was the only one which had been seen" that this individual was identical with that mentioned by Collins, is another matter, but it seems at least probable. Shaw's type came later into the hands of Dr. Latham, who presented it to the British Museum, where it still remains, but I cannot get access to any further facts or details as to its history. Mr. Oldfield Thomas writes me that it is a male, with the spurs cut off close to the base. In a description by Governor Hunter, to which I shall presently come, of the spearing of a Platypus by a native, he mentions that the animal struggled so violently that it had to be confined between two pieces of board while the spear was being

removed. It may well be that the native, fearing the spurs, shore them off at the same time. This capture would appear to be the same as that mentioned by Collins, though there is no absolute certainty.

Of the two specimens sent to Banks by Governor Hunter, one was given by the former to Professor Blumenbach, of Gottingen, who published a description of it in *Voigt's Magazin* (Bd. II., 1800). This description is not available in Sydney, but Mr. Oldfield Thomas has very kindly given me the gist of it. Blumenbach gave the animal the name of *Ornithorhynchus paradoxus*, being, presumably, in ignorance of Shaw's prior description. It so happened that Shaw's generic name *Platypus* had been used by Herbst in 1793 for a genus of Coleoptera, so that Shaw's generic name could not stand. The correct name of the Platypus is therefore *Ornithorhynchus anatinus* Shaw, though this did not come to be recognised or admitted until a much later date.

Blumenbach specifically mentions that the specimen he described was the first that had been sent out of England, so it seems reasonably certain that only three specimens were known in Europe up to 1800, that in the hands of Mr. Dobson, and those sent by Hunter to Banks. I have not succeeded in tracing any reference to the latter at this end. A search of the *Historical Records of New South Wales* discloses advices of two specimens only. King writes to Banks under the date 28th September, 1800:—"I send you by the hands of Capt. Kent, who is nephew to the Governor Hunter, and commands the Buffalo which he takes home with him, a cask in which is a water-mole . . ." (*Hist. Rec.* IV., p. 205). In due course Kent writes from on board the Buffalo in Portsmouth Harbour, on 1st July, 1801:—"The keg containing the water-mole and other articles in spirits . . . I have still on board." (*loc. cit.*, p. 427).

Everard Home described the anatomy of the Platypus in the *Philosophical Transactions* for 1802, from two specimens, male and female, sent in spirit to Sir Joseph Banks. The individual mentioned above would certainly be one of these, but of the other I can find no mention. In a second paper by Home in the same volume (1802, p. 356), I find the following words:—" . . . had I not been favoured by Sir Joseph Banks with a specimen of the paradoxus brought from New South Wales by Mr. Belmain." Belmain, whose name is still borne by the water-side suburb of Sydney which has grown up about his original land grant, came out as Assistant Surgeon with the First Fleet, succeeded John White as Head Surgeon in 1796, and returned to England on leave by the Albion, arriving in March, 1802. A quantity of specimens was placed by King in his personal charge for delivery to Banks. (*Hist. Rec.*, IV., pp. 514-5). I take it that the specimen brought by Belmain did not form part of the material examined by Home in his earlier paper, but there is a possibility that I am wrong in this.

Of the first five (or six) specimens which reached England, then, one dry skin was held by Mr. Dobson, one by Banks presumably, and a third was sent to Blumenbach, while two (or three) spirit specimens, sent to Banks, were examined by Home. It would probably be comparatively easy to trace the history of these specimens, were one in England. The twenty-one folio manuscript volumes of Banks' papers in the library of the British Museum would pretty certainly disclose further particulars. But the facts and inferences which I have given are all I can glean in Australia.

The first account of the habits of the Platypus is that given to Home by Hunter. Home writes (*Phil. Trans.*, 1802, p. 67):—"Governor Hunter, who has lately returned from New South Wales"—he landed in England on 24th May, 1801—"where he had opportunities of seeing them alive, has favoured me with the following particulars respecting them."

"The *Ornithorhynchus* is only found in the fresh-water lakes, of which there are many in the interior parts of the country, some three-quarters of a mile long, and several hundred yards broad. This animal does not swim upon the surface of the water, but comes up occasionally to breathe, which it does in the same manner as the turtle. The natives sit upon the banks, with small wooden spears, and watch them every time they come to the surface, till they get a proper opportunity of striking them. This they do with much dexterity; and frequently succeed in catching them in this way.

"Governor Hunter saw a native watch one for above an hour before he attempted to spear it, which he did through the neck and fore leg; when on shore, it used its claws with so much force, that they were obliged to confine it between two pieces of board, while they were cutting off the barbs of the spear, to disengage it. When let loose, it ran upon the ground with as much activity as a land tortoise; which is faster than the structure of its fore feet would have led us to believe. It inhabits the banks of the lakes, and is supposed to feed in the muddy places which surround them; but the particular kind of food on which it subsists, is not known."

As Collins' *New South Wales* was not published until 1802, by which time Home's paper had appeared, and a copy had been sent by the author to Collins, the latter was able to include a further account of the *Platypus*, abstracted from Home (1802, pp. 321-328). There was also included an engraving of the animal "from a drawing made on the spot by Governor Hunter," which appears on p. 63, with the following legend:—

"An Amphibious Animal of the Mole Kind which inhabits the Banks of fresh water Lagoons in New South Wales its fore feet are evidently their principal assistance in Swimming their hind feet having Claws extending beyond the Web'd part are useful in burrowing."

The first drawing of the *Platypus* was thus made by Governor Hunter. What was probably the earliest drawing of the *Echidna* was, curiously enough, made by Captain, afterwards Governor, Bligh. Home, who first realised the close relationship between these two monotreme species, included the *Echidna* in the genus *Ornithorhynchus* in a paper on its anatomy in the *Philosophical Transactions* for 1802. On page 357 of this paper we read:—"Another species of *Ornithorhynchus*, of the same size as the *Hystrix*, was shot at Adventure Bay, Van Diemen's Land, by Lieutenant Guthrie, in the year 1790, a drawing of which was made by Captain Bligh, and sent to Sir Joseph Banks, who has allowed me to annex a copy of it to this paper." The "copy" duly appears on Plate xiii., and it is to be hoped that it has not done justice to the original.

This action of Home in transferring the *Echidna* to the genus *Ornithorhynchus* has been the cause of a misunderstanding which may as well be cleared up here. Ida Lee, in *Captain Bligh's Second Voyage*, London, 1920, says on p. 20:—"The platypus, however, was quite new to the discoverers, and we are told Lieutenant Guthrie killed 'an animal of a very odd form.'" Mr. Hugh Wright informs me that the correct date is 1792. He has looked up the reference in Bligh's original M.S. copy of his journal, and the animal is undoubtedly the *Echidna* figured by Home, and not a *Platypus*.

Hunter's account forms the basis of most statements concerning the economy of the animal which appear in European works on natural history during the next three decades. Since the first discovery was made "on the banks of a lake near the Hawkesbury," the *Platypus* is invariably given as a dweller on the banks of lakes, and its more customary habitat in rivers is not mentioned. Mr. Henry Selkirk, a Hawkesbury native of whom I sought information, thinks it probable that the lake mentioned as the site of the first discovery is one of

several lagoons close to the town of Richmond. He himself, as a boy, made his first acquaintance with the Platypus in these waters.

With the discovery of the Platypus there was inaugurated a century of trouble for the zoologist. If the external form of the beast was so extraordinary as to be incredible, its internal anatomy proved more wonderful and incredible still. We may quote some early opinions.

Shaw (1809):—"This Quadruped therefore may be considered as the miracle of modern zoology."

"This most extraordinary and dubious quadruped is a native of Australasia . . . If there be no mistake in the anatomical disquisitions hitherto made on the Duckbill, its internal structure is not less extraordinary than its external . . ."

Lesson (1839):—"It is in New South Wales that one meets those singular and fantastic creatures to which naturalists have not been able to assign position: The *Ornithorhynchus* or *paradoxus*, with a duck's beak, which live in the waters of the rivers, . . . creatures set in the path of the scientific method, to show its worthlessness."

Many more in a similar vein might be quoted, but these are enough. Every writer upon the Platypus begins with an expression of wonder. Never was such a disconcerting animal! This wonder finds a very curious expression in the determined efforts made to retain Blumenbach's name *paradoxus*, against all the rules of zoological nomenclature. A "paradoxical bird-bill" was more to the taste of naturalists mazed with surprise, and doubt than a "duck-like flat-foot." Even Everard Home, the English anatomist, writing less than two years after Shaw's original description, uses the name given by the German author.

An amusing and barefaced attempt to justify the use of Blumenbach's name is made by Chenu (1879). On p. 349, after mentioning that Shaw had described the Echidna, under the name of *Myrmecophaga aculeata*, in 1792, he states that:—" . . . four years later, Blumenbach, in 1796, having observed a skin of a curious animal which Banks had sent him, was struck by the resemblance of the curious kind of beak which terminates it to that of a duck, and made it the type of a new genus, which he called, because of this, *Ornithorhynchus* . . .; he applied also appropriately to the species the name *paradoxus* Shaw, not knowing Blumenbach's work, made the same animal the type of his *Platypus anatinus*."

Shaw could scarcely have been expected to know Blumenbach's work, since it did not appear until the year after his own description. At the time, 1796, attributed by Chenu to Blumenbach, the Platypus had not been discovered in Australia. But Chenu has not finished, and on p. 352 writes:—"As we have said in our general account of the Monotremes,"—this is what I have just quoted above—"the genus *Ornithorhynchus* was created, in 1800, by Blumenbach; this name, most happily chosen since it recalls one of the best characters of the included species, has nevertheless been changed by some zoologists. About the same time as Blumenbach, Shaw has named it *Platypus*, and Wiedemann, *Demipus*; but the name of *Ornithorhynchus* has generally prevailed."

The name *Ornithorhynchus* certainly has prevailed, but for reasons other than those given by Chenu; but the name *paradoxus* has gone by the board, despite this brave effort.

The chief controversies which followed upon the discovery, description, and naming of the Platypus were concerned with:—

- (1) Its zoological status, depending largely upon whether, or not, it possessed mammary glands.
- (2) Whether it were oviparous, ovo-viviparous, or viviparous.
- (3) The use of the spurs of the male.

I do not propose to touch upon the third controversy in these notes, as it is still of speculative rather than historical interest. Nor do I propose to give full bibliographical references. I shall have to traverse in summary fashion the opinions of a great many workers, and a bibliography would bulk almost as large as the notes. Any who is curious to follow the matter further may do so by reference to Fletcher's excellent bibliography of Marsupialia and Monotremata (*Proc. Linn. Soc. N.S.W.*, ix., 1884, pp. 809-863).

To Shaw, the first zoologist to handle a Platypus, the animal was obviously a mammal, since it had a furry covering, and he placed it in the lowest Linnean Order, *Bruta*, which included what we know now as the *Edentata*—anteaters, sloths, and the like.

Home was an anatomist, not a systematic zoologist, and was not deeply concerned about the systematic position of the animal, the anatomy of which he was describing. He notes the remarkable character of the organs of reproduction, both in male and female, and remarks on the latter:—"This structure of the female organs is unlike anything hitherto met with in quadrupeds; since in all of them that I have examined, there is the body of the uterus, from which the horns go off, as appendages. The opossum differs from all other animals in the structure of these parts, but has a perfectly formed uterus; nor can I suppose it wanting in any of the class *Mammalia*."

Finding that these organs were not comparable with those of mammals, Home was led to examine the corresponding parts in birds and reptiles, and finds most resemblance to the organs of ovo-viviparous lizards. He concludes:—"There is therefore every reason to believe that this animal also is ovi-viviparous in its mode of generation."

Later, he writes:—"These characters distinguish the *Ornithorhynchus*, in a very remarkable manner, from all other quadrupeds, giving *this new tribe* a resemblance in some respects to birds, in others to the *Amphibia*; so that it may be considered as an intermediate link between the classes *Mammalia*, *Aves*, and *Amphibia* Between it and the bird, no link of importance seems to be wanting." Home's main reason for this conclusion lay in the fact that the oviducts of the female opened separately into the cloaca, and did not unite to form a uterus, as in mammals in general.

Etienne Geoffroy (1803) included *Ornithorhynchus*, with the *Echidna*, in a new order, *Monotremata*, but he did not give any precise indication as to where this order should be placed.

Tiedemann (1808) avoided the difficulty by placing it in an appendix.

Lamarek (1809) created a new class, *Prototheria*, for *Platypus* and *Echidna*, pointing out that they were not mammals, for they had no mammary glands, and were probably oviparous; they were not birds, for their lungs differed, and they had no wings; and they were not reptiles, for they possessed a four-chambered heart.

Illiger (1811) placed them in a division *Reptantia*, intermediate between reptiles and mammals.

Blainville (1812), on the other hand, was convinced that they were mammals, though belonging to a separate order, *Ornithodelphia*. He was the first to indicate their many points of agreement with the marsupials, and he gave a long list of mammalian resemblances.

Etienne Geoffroy was convinced from the outset that the *Platypus* was not a mammal, and entered into a controversy with Blainville which lasted for many years. Van der Hoeven and Latreille were on his side, while Cuvier and Meckel supported Blainville. The discovery of the mammary glands was announced by Meckel in 1824, but his full description was not published until 1826. Fur, diaphragm, and mammary glands would appear sufficient to settle the matter,

But Geoffroy was not daunted. He returned to the charge. The Monotremes must be removed from the Mammalia, because their reproductive organs and several other parts of the great systems placed them amongst the oviparous classes. They could not be included in the birds, because they had neither wings nor feathers. Nor could they be placed amongst the reptiles, for their blood was warm, and their lungs were enclosed in pleura, and shut off by a diaphragm from the abdomen. Still less were they fish, which breathe by means of gills.

They were mammals without the mammalian character, without the special organisation of viviparous animals, without all the consequences and functions of an apparatus capable of producing a placental foetus. Therefore they must have a special class to themselves.

And Meckel dared to discover mammary glands! Geoffroy rushed off to examine a specimen, found the glands, saw that they differed from those of the higher mammals, and triumphantly asserted that they were not milk-glands at all. But, notwithstanding his strenuous opposition, the Monotremes came to be included in the Mammalia, as the lowest sub-class of the three comprising the class, despite the fact that the actual method of reproduction did not become known until 1884.

Geoffroy's final despairing effort to disprove the mammary nature of the glands is too good to be omitted. He compared them to the "so-called" mammary glands of whales and porpoises, which secreted, not milk, but mucus. This coagulates on being ejected into the water, and is then devoured by the young. Unfortunately, just as he had elaborated this hypothesis, he had the ill fortune to secure a nursing porpoise, and found that the glands secreted milk.

The production of milk by *Ornithorhynchus* was definitely recorded by Maule (1832) and Bennett (1833).

The second great controversy was concerned with the method of reproduction. Home (1802), from an examination of the reproductive organs in the female, suggested that the Platypus might be ovo-viviparous. By 1819 he has become so convinced of this that he makes the following categorical statement, for which no scintilla of evidence existed:—"In the ornithorhynchi the yolk-bags are formed in the ovaria; received into the oviducts, in which they acquire the albumen, and are impregnated afterwards; the foetus is aerated by the vagina, and hatched in the oviduct, after which the young provides for itself, the mother not giving suck."

Those zoologists who considered the Platypus to be definitely a mammal of course believed that it brought forth its young alive. Among these we may include Blainville, Cuvier, and Oken. The last (1817) suggested that the mammary glands might occupy some unusual situation, and so have escaped notice; and later (1823) commenting on the ovarian ovum described by Hill (see below) points out its resemblance to the mammalian Graafian follicle, and concludes by saying that the tales of oviparity and ovo-viviparity have all arisen from the fact of mammary glands not having been observed. Oken's assurance of the existence of mammary glands was justified, as we have seen, by the discovery of these glands by Meckel, announced in 1824.

It seemed likely, then, that despite the opposition of Geoffroy St. Hilaire, and the extraordinary form of the animal itself, and of its reproductive apparatus, *Ornithorhynchus* would turn out to be quite an ordinary mammal, which produced its young alive. But persistent reports came from the colonists of New South Wales that it laid eggs. Sir John Jamison (1818) wrote without comment, as if citing an established fact:—"The female is oviparous, and lives in burrows in the ground." This would seem to indicate that nesting burrows and eggs had definitely been observed, yet no evidence was forthcoming to calm the agitation of European zoologists.

Dr. Patrick Hill (1822) examined what he believed to be an impregnated female, in the left ovary of which was a large Graafian follicle. This specimen was sent to England, and was responsible for the various reports that actual Platypus eggs had been sent there. Hill quotes the statement of an aborigine "that it is a fact well-known to them, that this animal lays two eggs, about the size, shape, and colour of those of a hen." This error as to size—the egg of the Platypus is only three-quarters of an inch in length—may have been due to misunderstanding on the part of Hill, but, from this time on, there is a very definite "henniness" about all statements as to Platypus eggs. Lesson (1825) says:—"Mr. Murdoch, superintendent of the farm at Emu-plains, assured me that he had found the eggs of *Ornithorhynchus*, and that they are of the size of those of a domestic fowl."

Etienne Geoffroy (1829) at last triumphantly produced a description and figure of veritable eggs, taken to the number of four by one Mr. Holmes from a sandbank in the Hawkesbury, to which his attention was drawn owing to a Platypus leaving the spot. Two of these eggs came to the Manchester Museum, and two into the possession of Mr. Leadbeater. It is a drawing of one of these latter that Geoffroy reproduces, and it is at once obvious to an Australian zoologist that the egg is that of the common long-necked tortoise (*Chelodina longicollis*). Geoffroy, however, described it as the egg of *Ornithorhynchus*, and it was only after he had published his description that he paused to realise that the diameter of the pelvic ring of the Platypus, through which the egg had to pass, was but five-twelfths of an inch, while that of the egg was nine-twelfths. To meet this difficulty, Geoffroy first supposed that the egg passed to the cloaca in a not fully developed condition, and underwent further development there, but so rapidly as not to cause serious obstruction. Later, however, in 1833, he discarded this view, and considered that it remained in the oviduct until hatching took place, since it could not pass through the small pelvis. He would seem to have conveniently forgotten that the eggs were found laid in a nest in the sand.

But though Geoffroy fell so often into error in support of oviparity, he ultimately proved right. The great Richard Owen, on the other hand, through too firm and convinced a belief in ovo-viviparity, rejected evidence which, in the light of our later knowledge, was convincing enough, and was proved, in the upshot, wrong. Maule (1832) first recorded the opening up of nesting burrows, from which he obtained the first described young. He writes:—"No eggs were found in a perfect state, but pieces of a substance resembling egg-shell were picked out of the *debris* of the nest." There is no reason to doubt that these actually were egg-shells, but Owen altogether ignores the statement. Owen was largely influenced by Dr. George Bennett, who, because he could not obtain eggs, and had received conflicting stories concerning them from the aborigines he questioned, had become convinced that the Platypus was viviparous.

In 1865 Owen published correspondence from Australia concerning a female Platypus which had been captured and placed over night in a box. The next morning two eggs, which "were white, soft and compressible," were found in the box. Here again Owen would seem to have ignored positive evidence and accepted a suggestion of one of his correspondents that these were "abortions due to fear."

In 1869 the writer of an anonymous series of articles in the *Australian Journal of Education* states with regard to the Platypus that the egg-laying idea is "exploded." In the *Proceedings of the Royal Society of Tasmania* for 1878 there appears a discussion of the question, which most members think has been settled in the negative. Mention was made, however, that Professor McCoy had recently received reliable evidence that *Ornithorhynchus* was oviparous.

The question was not finally cleared up until 1884, when W. H. Caldwell, a Cambridge zoologist who came to Australia especially to investigate the reproduction of Monotremes and Marsupials, obtained eggs of both Platypus and Echidna in the Burnett River district of Queensland. This fact was announced to the scientific world by a dramatic cable, which Caldwell sent to the British Association for the Advancement of Science, then sitting at Montreal, which was read to the conference on 2nd September, 1884.

NOTES ON BERNARD'S KANGAROO, *MACROPUS BERNARDUS*.

By A. S. Le Souef.

Dendrodorcopsis woodwardi Rothschild, *Nov. Zool.* v. 3, 1903, p. 414 (Not *Macropus robustus woodwardi* Thomas, 1901).

Macropus bernardus Rothschild, *Tom. cit.* v. 4, 1903, p. 543. *Id.* Thomas, *Nov. Zool.* v. 11, 1904, p. 225.

In November, 1918, five Bernard's Kangaroos were received by the Taronga Park Trust from Mr. Cahill, who caught them near Onipelli Station, South Alligator River, Northern Territory. The following observations are based on these specimens, two of which are now in the Australian Museum, and numbered M. 2938 ♂, and M. 2939 ♀. The colouration of the female does not appear hitherto to have been described.

These animals are of the *robustus* type, but are very much smaller with proportionately smaller ears, and their feet better adapted for travelling on rough rocky country. The males are black, while the females are brownish-grey and only about two-thirds the size of the male. The sexes therefore show the same disproportion in size as in *M. robustus*.

In the early winter, the males of *M. bernardus* are glossy black with distinctly hairy fur, but with the advent of summer, the colour gradually changes to rusty black, especially on the back. At the end of the summer, when the colour is changing to black, they often appear patchy owing to the colour changing irregularly over the body.

The female is light grey in winter, and changes to brownish grey with the flanks and under surface fawn. The hair is not woolly, and is two inches long in places. The paws and feet are black, the tip of the tail dark brown, the face evenly coloured, and the nose black. The total length is 1185 mm., the tail 540 mm., and the ear 63 mm.

Mr. Cahill states that these animals are found on rough hilly country, and being very agile among the rocks and scrub, are hard to procure. In captivity they were very quiet and docile.

THE GEOGRAPHICAL DISTRIBUTION OF GENERA BELONGING TO THE DIPTERA BRACHYCERA OF AUSTRALIA.

By G. H. Hardy.

Introduction.—The Diptera Brachycera have been sufficiently studied to make it practicable to tabulate the range of the Australian genera. The main portion of this tabulation is based upon the study of Australian species of Diptera which are sorted as far as possible into their genera and to this are added records from works dealing with these genera from other parts of the world.

The compiled portion of this paper is based upon the work of many entomologists, some of whom are publishing results of their studies upon the Diptera Brachycera within circumscribed areas whilst others are limiting their researches to certain families of this group, but, however, covering a wider distribution.

The usefulness of these works depends upon the accuracy of the records and the manner in which the subject matter is presented. In many cases there is much to be desired in these respects as some authors are content to let the identification of genera rest upon characters of rather doubtful generic value and do not attempt to write a satisfactory definition covering the species known to them.

The task of describing new species and at best giving keys to the genera is so palpably easy that the advanced work of defining genera is too frequently ignored with the result that the original and often unsatisfactory definitions are too much relied upon for the best results to be obtained.

Nevertheless there appears to be a considerable uniformity in the understanding of genera of the Diptera Brachycera and it seems worth while to tabulate the distribution even in the present incomplete state of our knowledge.

Amendments.—A striking weakness in our knowledge of the insect fauna of those islands lying between Australia and the mainland of Asia, and the islands in the Pacific (referred to here as the Malayan and Polynesian Islands), is emphasised by the gaps filled with dotted lines in the tabulation below. The genera with their distribution so marked undoubtedly occur in this region but species belonging to them have not been described or reported from there.

To overcome the slender knowledge of the Malayan and Polynesian diptera, an amended set of figures is given in brackets and is obtained by including the dotted lines when counting the number of genera known from the region. Although the table of percentages is improved in this manner it will be noted that the amended numbers are lower than those of South America from where the known dipterous fauna is also limited.

Undoubtedly various genera known only from Australia will yet be found either in the Malayan and Polynesian Islands or in South America; and vice versa, some of the genera only known from these regions will yet be found in Australia.

Genera classified on records of distribution.—Various Australian entomologists are attempting to discover, amongst the families of insects they are studying, genera that can be classified into one or more of the following groups:—

1. Genera limited to Australia.
2. Genera that have invaded Australia from the North.
3. Genera that have a bearing upon the theory that Australia at one time was connected with South America via the Antarctic land.

The table given below shows the possibility of being able to place certain genera into these classes but any serious attempt to do so would be impaired in value by the admitted incompleteness of our records.

Table of percentages.—The Diptera Brachycera are represented by 156 genera known to me from Australia and this number includes some not previously recorded and omits others inaccurately recorded from the region.

Of these genera 33 (21%) are cosmopolitan and 73 (46.8%) are only known from Australia. Other figures are given in the following table:—

| | Number of the tabulated genera occurring in the seven regions. | Percentage of the Australian genera known from other regions. | Number of the tabulated genera less the 33 of cosmopolitan distribution. | Percentage of the Australian (excluding cosmopolitan) genera known from other regions. |
|-----------------------------------|--|---|--|--|
| North America .. | 54 | 34.6 | 21 | 17.1 |
| South America .. | 68 | 43.6 | 35 | 28.5 |
| Australia | 156 | — | 123 | — |
| Malayan and Polynesian Islands | 53 | 33.9 | 20 | 16.3 |
| Amended figures for these islands | (66) | (42.2) | (33) | (26.8) |
| Asia | 52 | 33.3 | 19 | 15.4 |
| Europe | 46 | 29.6 | 13 | 10.6 |
| Africa | 40 | 25.5 | 7 | 5.7 |

Remarks.—In the table showing the dispersal of the genera there are several cases where a genus is stranded in one or more regions and does not appear to have a continuous distribution. In the course of time many of these will be joined by the discovery of species in the intermediate regions. Other genera have similar distributions which are too incongruous to pass without remark.

Krober, in his revisions on the Therevidae has recorded the genera *Ectinorhynchus* and *Anabarrhynchus* from Africa. Both these genera are typical of the Australian and South American regions and it seems probable that the African species placed in them do not strictly belong there. A study of Krober's work, as far as the Australian material is concerned, has convinced me that in many cases he has failed to appreciate certain characters of generic value and on this account I feel certain that the African species placed by Krober in the two genera referred to will ultimately be removed to some other position.

The cosmopolitan genera include many that will be divided into more than one genus when they are properly studied. This is especially the case with genera containing long series of species such as *Neotamus* (used in a very wide sense in the table) which is receiving attention at the present time.

Some of the genera belonging to the *Empidae* and *Dolichopodidae* are only known from restricted areas and these will probably be found widely distributed when more attention is given to them. Several genera belonging to the former family are added to the Australian fauna for the first time in this list.

In the Tabanidae the genus *Dasybasis* is omitted from the numbers counted as it has not been satisfactorily recognised during recent years. The occurrence

of the genus *Stibosoma* is somewhat doubtful and also omitted, together with *Diclisia*.

Summary.—Despite the fact that the distribution of genera is still imperfectly known, evidence that Australia has a strong zoological affinity with South America is too prominent to be ignored. The 28.5 % of genera in common with South America against the 5.7 % in common with Africa is too wide a difference to be accounted for except by the theory that Australia and South America derived a large part of its fauna from a common origin and it corroborates similar evidence in other branches of Zoology.

Further additions to our knowledge are required before any safe conclusions can be drawn from the facts of the distribution and in the meantime it is hoped that the tabulation given here will be found suggestive enough to stimulate further enquiry.

Mr. Charles Hedley in "The Palaeographical Relation of Antarctica" (*Proc. Lin. Soc. Lond.*, 1912, p. 80, reprinted in *Smithsonian Instit.*, 1913, p. 443) has ably championed a theory that Australia has been connected to South America via the Antarctic continent. If this could be proved and the geological period of such connection determined, it would have a far reaching effect upon the study of the phylogeny of dipterous and other genera.

[See Tables pages 146-7.]

| | North America | South America | Australia | Malayan & Polynesian Islands | Asia | Europe | Africa | | North America | South America | Australia | Malayan & Polynesian Islands | Asia | Europe | Africa |
|-----------------------|---------------|---------------|-----------|------------------------------|------|--------|--------|--------------------------|---------------|---------------|-----------|------------------------------|------|--------|--------|
| LEPTIDAE | | | | | | | | TABANIDAE (Cont.) | | | | | | | |
| Chrysopilus | | | | | | | | (Diclisa) | | | ? | | | | |
| Atherimorpha | | | | | | | | Erephopsis | | | | | | | |
| Dasyomma | | | | | | | | Pangonius | | | | | | | |
| Spaniopsis | | | | | | | | Diatomineura | | | | | | | |
| Austroleptis | | | | | | | | Pseudotabanus | | | | | | | |
| STRATIOMYIIDAE | | | | | | | | Coenoproscopon | | | | | | | |
| Metoponia | | | | | | | | Corizoneura | | | | | | | |
| Chiromyza | | | | | | | | Pseudopangonia | | | | | | | |
| Boreoides | | | | | | | | Silvius | | | | | | | |
| Neocexaireta | | | | | | | | Mesomyia | | | | | | | |
| Xanthoberis | | | | | | | | Chrysops | | | | | | | |
| Actina | | | | | | | | Phibalomyia | | | | | | | |
| Pachygaster | | | | | | | | Parasyllivius | | | | | | | |
| Lonchegaster | | | | | | | | Palimnecomyia | | | | | | | |
| Evana | | | | | | | | Cydistomyia | | | | | | | |
| Wallacea | | | | | | | | BOMBYLIIDAE | | | | | | | |
| Peratomastix | | | | | | | | Hyperalonia | | | | | | | |
| Massicyta | | | | | | | | Exoprosopa | | | | | | | |
| Hermetia | | | | | | | | Anthrax | | | | | | | |
| Sargus | | | | | | | | Argyromoebe | | | | | | | |
| Acanthasargus | | | | | | | | Cytheria | | | | | | | |
| Negritomyia | | | | | | | | Lomatia | | | | | | | |
| Geranopus | | | | | | | | Oncodocera | | | | | | | |
| Rhassoma | | | | | | | | Comptosia | | | | | | | |
| Ophiodesma | | | | | | | | Docidomyia | | | | | | | |
| Anacanthella | | | | | | | | Systropus | | | | | | | |
| Lecomyia | | | | | | | | Eolimus | | | | | | | |
| Antissa | | | | | | | | Marmasoma | | | | | | | |
| Antisella | | | | | | | | Antoniaustralia | | | | | | | |
| Odontomyia | | | | | | | | Cyrtomorpha | | | | | | | |
| SCENOPIINIDAE | | | | | | | | Geron | | | | | | | |
| Scenopinus | | | | | | | | Acroetrichus | | | | | | | |
| Pseudatrichia | | | | | | | | Phthiria | | | | | | | |
| TABANIDAE | | | | | | | | Dischistus | | | | | | | |
| (Dasybasis) | | | | | | | | Systoechus | | | | | | | |
| (Stibasoma) | | | | | | | | Sicyromyia | | | | | | | |
| Tabanus | | | | | | | | Bombylius | | | | | | | |
| Acanthocera | | | | | | | | CYRTIDAE | | | | | | | |
| Apocampa | | | | | | | | Pterodontia | | | | | | | |
| Ectinopsis | | | | | | | | Nothra | | | | | | | |
| Demoplatys | | | | | | | | Oncodes | | | | | | | |
| Pelecorrhynchus | | | | | | | | Leucopsina | | | | | | | |
| | | | | | | | | Epicerina | | | | | | | |
| | | | | | | | | Panops | | | | | | | |

| | North America | South America | Australia | Malayan & Polynesian Islands | Asia | Europe | Africa |
|-------------------------|---------------|---------------|-----------|------------------------------|------|--------|--------|
| NEMESTRINIDAE | | | | | | | |
| Trichophthalma | | | | | | | |
| Tricopsidea | | | | | | | |
| Nycterimyia | | | | | | | |
| Exeretoneura | | | | | | | |
| MYDAIIDAE | | | | | | | |
| Triclonus | | | | | | | |
| Diechistus | | | | | | | |
| APIOCERIDAE | | | | | | | |
| Apiocera | | | | | | | |
| ASILIDAE | | | | | | | |
| Leptogaster | | | | | | | |
| Chrysopogen | | | | | | | |
| Opseostlengia | | | | | | | |
| Phellus | | | | | | | |
| Psilozona | | | | | | | |
| Bathypogen | | | | | | | |
| Deromyia | | | | | | | |
| Erythropogon | | | | | | | |
| Saropogon | | | | | | | |
| Dioctria | | | | ---- | | | |
| Neodioctria | | | | | | | |
| Stenopogon | | | | | | | |
| Cryptopogon | | | | | | | |
| Neosaropogon | | | | | | | |
| Neocyrtopogon | | | | | | | |
| Cabasa | | | | | | | |
| Brachyrrhopala | | | | | | | |
| Codula | | | | | | | |
| Rachtopogon | | | | | | | |
| Promachus | | | | | | | |
| Blepharotes | | | | | | | |
| Pararatus | | | | | | | |
| Neoitamus | | | | | | | |
| Asilus | | | | | | | |
| Ommatius | | | | | | | |
| Laphria | | | | | | | |
| Nusa | | | | ---- | | | |
| Atomoesia | | | | | | | |
| Aphesia | | | | | | | |
| Maria | | | | | | | |
| Thereutria | | | | | | | |
| ASILIDAE (Cont.) | | | | | | | |
| Cyanomydis | | | | | | | |
| Metalaphria | | | | | | | |
| Adeolus | | | | | | | |
| THEREVIDAE | | | | | | | |
| Belonalyse | | | | | | | |
| Taenogera | | | | | | | |
| Ectinorrhynchus | | | | | | | |
| Anabarrhynchus | | | | | | | |
| Platycaenum | | | | | | | |
| Psilocephala | | | | | | | |
| Agapophytus | | | | | | | |
| Phycus | | | | ---- | | | |
| Acatopygia | | | | | | | |
| Acupaipa | | | | | | | |
| Lonchorhynchus | | | | | | | |
| Oldenbergia | | | | | | | |
| Parapsilocephala | | | | | | | |
| Pseudoloxocera | | | | | | | |
| Acraspisa | | | | | | | |
| Clesthentia | | | | | | | |
| Spatulipalpa | | | | | | | |
| Eupsilocephala | | | | | | | |
| EMPIDAE | | | | | | | |
| Ironomyia | | | | | | | |
| Sciadocera | | | | | | | |
| Hybos | | | | | | | |
| Hilara | | | | | | | |
| Empis | | | | | | | |
| Hilarempis | | | | | | | |
| Hilaropus | | | | | | | |
| Anthipiscopus | | | | ---- | | | |
| Tenontomyia | | | | | | | |
| Rhamphomyia | | | | | | | |
| Microphorus | | | | ---- | | | |
| Leptopeza | | | | | | | |
| Hemerodromia | | | | | | | |
| Philophyllodromyia | | | | | | | |
| Drapetis | | | | | | | |
| DOLICHOPODIDAE | | | | | | | |
| Scapulus | | | | | | | |
| Diaphorus | | | | ---- | | | |
| Liparomyia | | | | | | | |
| Arachnomyia | | | | | | | |

DESCRIPTION OF THE COPPINIA OF AN AUSTRALIAN HYDROID

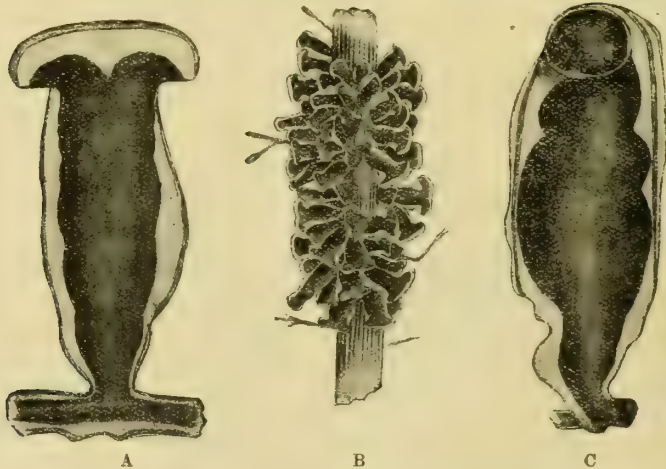
By E. A. Briggs, B.Sc.,

(Lecturer in Zoology, University of Sydney.)

(With a Figure in the text.)

In the report on the "Hydrozoa (Hydroid Zoophytes and Stylasterina)" obtained by the "Thetis" Expedition during trawling operations within the one hundred fathom line off the coast of New South Wales, Dr. Ritchie (7) described, under the name of *Lictorella concinna*, a small number of colonies from Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms. He had only sterile specimens for examination, but several fine colonies of this species, on one of which I found a coppinia mass, occur among some hydroids which were recently dredged off Botany Bay, N.S. Wales, at a depth of 50 fathoms. These specimens are somewhat larger than those originally described and reach a height of 30 mm.

The coppinia, which, as far as I am aware, has not hitherto been observed, consists of a mass of loosely aggregated gonangia, and probably indicates a transition between those forms in which the gonangia are firmly bound to each other and those with separated gonangia.



Text-fig. 1.—*Lictorella concinna*. A. Gonangium seen in frontal aspect.
B. Coppinia on main stem. C. Gonangium seen in lateral aspect.

GONOSOME OF *LICTORELLA CONCINNA*.—The gonangia are attached in a dense cluster to the main stem forming a coppinia mass which surrounds it on all sides. The great majority of the gonangia stand out at right angles from the stem; a few, however, are more or less closely appressed to its surface. This mass of aggregated gonangia occupies a length of 3.5 mm., on the main stem and comprises some ninety individual gonothecae. The gonangia are ovate with undulated edges, truncated at the distal end, and tapering towards the proximal extremity. They usually pass into the very short peduncle gradually and without any distinct constriction or interruption. In frontal aspect each gonangium is a little narrowed in near the distal end and then widens outwards forming a conspicuous round projection or shoulder at each side of the top where the gonangium reaches its maximum width. These shoulders are produced slightly downwards into truncated processes, each of which ends in a small circular aperture directly facing towards the proximal extremity of the gonangium. The summit of the gonangium is usually convex, although in a few examples it may be slightly concave between the rounded shoulders. The gonangia attain a length of 0.77 mm., with a maximum width, in frontal aspect, of 0.33 mm., at the distal extremity. When viewed laterally the profile is obovate, and the gonangium reaches a maximum width of 0.28 mm., about two-thirds of the length of the body from the proximal end.

Ritchie has already drawn attention to the striking resemblance between the trophosome of *Lictorella concinna* and that of *Lictorella cervicornis*, Nutting (= *Zygophylax cervicornis*) from the Hawaiian Islands (6). Nutting's species, however, differs from *L. concinna* in that there is a nematophore at the base of each pedicle. There was no trace of these structures in the "Thetis" specimens, nor do they occur in the more abundant material which I now have at my disposal from a few miles south of the type locality. Although Ritchie considered the absence of nematophores in *L. concinna* significant, he was uncertain whether their presence or absence fell within the range of everyday variation, but the totally distinct gonosomes possessed by *Zygophylax cervicornis* and *Lictorella concinna* establish at once the validity of his species.

According to Nutting's description the gonosome of *Zygophylax cervicornis* has the following structure:—

"GONOSOME.—Gonangia forming a "Coppinia" mass on the main stem, roughly triangular in outline, the distal ends being the broader on account of the opposite shoulders, which are quite conspicuous and end in round apertures. Midway between these shoulders there is a short neck ending in a third aperture. The individual gonangia are borne on short branchlets, which continue beyond them, arching over each gonangium so as to form a protecting network of such branches over the aggregated gonangia."

Although *L. concinna* closely approaches *Lafoea convallaria*, Allman (1), the differences in the characters of the trophosomes are well-marked and the gonangia are quite distinct. Clarke (5) describes the gonangia of *L. convallaria* as "sessile and anchor-shaped, with the orifices, of which there are two in each gonangium, at the extremities of the obtusely pointed flukes."

II.—NOTES ON NOMENCLATURE.

During the course of preparation of a catalogue of the Hydroid Zoophytes of the coast of New South Wales certain changes in the nomenclature have been found unavoidable and it has been necessary to propose new names for three species. The reasons for such changes will be found under the species affected.

Family EUDENDRIDAE.

Genus EUDENDRIUM *Ehrenberg*.EUDENDRIUM LENDENFELDI *nom. nov.*

Eudendrium pusillum Lendenfeld, Proc. Linn. Soc. N.S.W., IX., 1885, p. 352 (name preoccupied; not *E. pusillum* Sars). Not *Eudendrium pusillum* Thornely, Ceylon Pearl Oyster Fisheries, pt. 11, Suppl. Rep. VIII.—Hydroida, 1904, p. 110, pl. 1, fig. 5.

As the name *Eudendrium pusillum* was used by Sars in 1857, I, therefore, substitute *Eudendrium lendenfeldi* for this species which was originally described by Lendenfeld from Port Jackson.

A comparison of Lendenfeld's type slide with Miss Thornely's description and figure of *E. pusillum* from Cheval Paar in the Gulf of Manaar convinces me that she has described a totally distinct species.

Family SERTULARIDAE.

Genus SERTULARIA *Linnaeus*.SERTULARIA BALEI *nom. nov.*

Sertularia loculosa Bale, Cat. Austr. Hydroid Zooph., 1884, p. 91 (part), pl. IV., fig. 5, 6, pl. XIX., fig. 9. *Id.*, Warren, Ann. Natal Govt. Mus., 1, 3, 1908, p. 306, pl. XLVIII., fig. 37, text-fig. 8. *Id.*, Bale, Proc. Roy. Soc. Viet., XXVI., 1913, p. 121, pl. XII., fig. 7, 8.

Sertularia turbinata Billard, Ann. Sci. Nat. Zool., (9), XI., 1910, p. 19 (in part).

? *Sertularia turbinata* Ritchie, Proc. Zool. Soc., 1910, p. 821.

Not *Sertularia loculosa* Busk.

Not *Dynamena turbinata* Lamouroux.

This species has been confused with *Sertularia loculosa* Busk, which Billard (4) has shown to be identical with *Dynamena turbinata* Lamouroux.

Bale (2) originally associated several forms under the name of *Sertularia loculosa*, some of which differ considerably from the typical form. He has since shown (3) that they represent more than one species, but while accepting the original name *Sertularia turbinata* (Lamouroux) for Busk's species, he has retained the name *Sertularia loculosa*, in a restricted sense, for this common short-celled form. This procedure being contrary to the rules of zoological nomenclature, I propose the name *Sertularia balei* for this species.

SERTULARIA TRYPHERA *nom. nov.*

Sertularia geniculata Bale, Proc. Linn. Soc. N.S. Wales, (2), III., 1888, p. 768, pl. XVII., fig. 6-11, (name preoccupied; not *Sertularia geniculata* Linnaeus).

As the name *Sertularia geniculata* was used by Linnaeus, I, therefore, substitute *Sertularia tryphera* for this species which was originally described by Bale from specimens in the Australian Museum collection from Port Jackson.

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2. BALE—Cat. Austr. Hydroid Zoophytes, 1884, p. 91.
3. BALE—Proc. Roy. Soc. Viet., (n.s.), XXVI., 1, 1913, p. 122.
4. BILLARD—Ann. Sci. Nat., Zool., (9), IX., 1909, p. 322.
5. CLARKE—Bull. Mus. Comp. Zool., V., 1878-1879, pp. 239-252, pls. I-V.
6. NUTTING—Bull. U.S. Fish. Commission, XXIII., 3, 1903 (1906), pp. 933-959, pls. I-XIII.
7. RITCHIE—Mem. Austr. Mus., IV., 1911, pp. 807-869, pls. LXXXIV-LXXXIX., and fig. 126.

COLOUR CHANGES IN BIRDS' FEATHERS.

By G. P. Heumann.

As a boy I wondered why European linnets should lose the carmine breast feathers in captivity, and since then I have kept in my aviaries many species of birds, which during the first moult in captivity lost the scarlet in their plumage, or the colour in which scarlet was a component part, like orange, either altogether, or at least changed it ranging down from yellow to a dirty pink or creamy white. For instance, the Sepoy Finch from India, a lovely scarlet bird, became yellow; the Scarlet Breasted Robin of Australia a poor pink, or a dirty white. What is the cause of these colour changes?

When I commenced my investigations into this interesting subject I supposed that the whole of the colouring matter as we see it in birds' feathers, was caused by the minute structure of the feathers. That is to say, I took it that colour as we see it was produced by interference of the light waves and that through unnatural feeding the minute parts of the barbicels would in captivity during the moult become stunted or malformed. If then there was any difference in the minute structure in the feathers and their positions before or after the moult, the quality of the light reflected therefrom would be different and in this way would create a change in colour in various degrees as the malformation might be slight or severe.

Chemical experiments conducted later have shown me the imperfection of the theory I had embraced, and I had to acknowledge the existence of pigment in feathers. Yet even the chemical colours must be subject to microscopical differences of structure of the infinitesimal parts of which pigment itself consists. If this be admitted then we might say that all colour is produced by structure.

Each feather as we know consists of barrel, shaft and aftershaft, and during the growing period of the feather the aftershaft is the medium through which the feather is fed.

The principal seat of the pigment which produces the chemical colours in the feathers seems to be in the capillaries of the mucous membrane which lies below the surface skin of the horny parts of the feather. When the feather has attained maturity the blood and the opaque substance in the aftershaft recede or dry up and now the feather is dead—at all events not subject any more to matter changes in the body.

The pigment is first transmitted by the parents to the offspring, that is to say by way of inheritance. The formation of the pigment, however, apart from

inheritance, is conditioned through light, warmth and food in the same way as the creation and disappearance of the chlorophyll in the cell of plants is dependent upon light and warmth. It is indeed remarkable that birds of different species living under the same conditions and eating the same food which consists of the same chemical ingredients should produce absolutely different colours.

Undoubtedly the subjective physical colours, that is to say the metallic shining shot colours which change according to light and angle looked at, are caused by feather structure, but light must be a principal factor in the creation of these wonderful colours in tropical birds. It is hard to say what influence temperature would have in the production of these colour effects. My Regent birds which have moulted out in a sunny aviary have reproduced their deep orange colour even after years of confinement, whilst those in a shaded aviary of a friend where sunlight is limited became a pale yellow. The feeding in both instances was the same.

How the pigment is created within the cells, distributed and enlivened seems to be enshrouded in mystery.

Besides warmth and food, light, colour changes may be created by selection, and in this way out of Bronze Manakins, Japanese Manakins in three colours have been produced; the yellow and the blue love birds out of the green ones. Further, through adaptation to surroundings, as in the case of quail, etc., or through age and other unknown influences. Very old King parrots will change with age, their scarlet to orange. That light has great influence upon and will even change the colour of dead feathers in live birds I have repeatedly proved to be the case. My experiments with Whydahs and Weavers have shown that when kept in a cage out of the sunshine melanism invariably was produced. I have often noticed the same condition amongst densely packed birds coming from over sea.

These birds suffering from melanism, placed in a large sunny aviary, would regain their normal healthy natural plumage after the first moult. One wonders how it is that melanism will attack the matured or dead feathers in a live bird, and yet sunlight has no influence upon this condition once it has set in; until the new moult comes around melanism remains. In my long experience with birds in freedom I have never come across one case of melanism, though I have seen it in rats and mice which are actually born with it. This leads me to believe that I am correct in assuming that it is darkness which produces melanism. I could never find that a blue colour in feathers suffered or was subject to these or other changes. I have noticed, however, that the blue contained in the skin of the bare parts in the face of the Blue faced Honey Eater fades away after a time in captivity. This, of course, has nothing to do with the moult. The Australian Oriole, whose bare facial parts are scarlet, invariably loses this colour when frightened and it will take weeks to regain it, though it vanishes in a moment.

In the same way as the food will influence the construction and activity of the animal cell, so it must have an influence upon the kind and the effect of the chemical colour matter. I need only mention the different colours of the canaries which can be produced as red, white, brown, etc. If cayenne pepper is mixed with the food for young canaries the result is red canaries, but if this food is given at a later period, that is to say when the birds are feathered then only the down and small feathers will show the colour change, as only these will be moulted out during the first moult, the larger feathers for the time being remain unchanged, for the reason that this feather is meanwhile dead and the matter changes within the body have ceased. This example is proof that foodstuffs materially influence the colouration of feathers and I am of opinion

that in this way the chemical colours may not only be maintained but also strengthened and improved, but of the ways and means in detail, how to achieve this are so far a closed door to me.

One fact I have settled to my entire satisfaction, and that is that both insectivorous and seed-eating birds require a certain amount of live food, which itself has lived upon live plants. They absolutely require this a few months before the moult sets in. I have tried this on Orange Bishops in conjunction with feeding on unripe seed, such as millet or grass-seed still in a milky state. I almost got back the original scarlet colour! Red-breasted Australian Robins fed upon mealworms exclusively produced a dirty pink after the first moult, others which received in addition to the ordinary soft bill food minced raw beef became almost white, which shows that the mealworms fed on dry vegetable matter like bran will not produce the natural scarlet in the feathers. During my experiments with the Sanguineous Honey-eater (Blood-bird) I allowed some of these to fly in a large outdoor aviary set with grape-vines and other plants, which attracted myriads of the tiny leaf-fly. The flies served the Blood-birds as food in addition to the sugar water they received. All these birds moulted perfectly into their natural scarlet plumage. At the same time others were placed in a large cage with plenty of sunlight, and fed on sugar water sprinkled only with dried and crushed cocoons of flies and with powdered flies. The birds did very well on this diet and moulted without trouble but—a washed-out pink! This seems to prove that it was the leaf-fly in conjunction with unlimited sunlight which caused the natural colour to reappear.

It is a remarkable fact that even in nature these colour changes always affecting the red pigment may take place unconditioned by age. I have seen in Fiji numbers of yellow headed Parrot Finches flying with flocks of red headed ones, the true colour of the species. I have had young ones of this species which eventually moulted out yellow headed, neither is it an uncommon thing to see yellow or copper headed Gouldians—the offspring of either black or redheaded ones; and I may state here that I received for several years running a silver white Galah, whose brothers and sisters out of the same nest were naturally coloured. I think I am safe in saying that it is only the scarlet which undergoes these variations, but where the actual cause lies is still a mystery to me beyond what I know of experiments. The common Blue Wren for instance, which breeds freely in my aviary, has always produced young which colour out according to nature, whereas the young of the Scarlet Backed Wren only show the dirty orange like the parent after the first moult. Now the young of the Scarlet Breasted or Red Capped Robins have never even moulted out a semblance of their natural bright scarlet.

During my experiments in artificially eliminating colour from feathers, I found that it can be done by a wash in chlor-ether, or chloroform. Removing some breast feathers from a Scarlet Breasted Robin, I found the new feathers formed a patch of dirty white amongst the still perfect original scarlet breast feathers, this seems to show conclusively that I had not been able to supply the necessary food for the production of the red colour pigment, and that the deposit of colour pigment in the old original scarlet feathers was not influenced or interfered with by food changes, for the simple reason that the old feather was not subject to matter changes in the body. In Parrots the colour changes are not nearly so frequent or so severe, the probability being that their nature better adapts itself to the food and life of captivity. If one begins to wonder how pigment has gradually been modified for the development of colour in nature one is lost almost as hopelessly as when one attempts to comprehend infinity or space.

ON THE MALLOPHAGAN FAMILY TRIMENOPONIDAE; WITH A
DESCRIPTION OF A NEW GENUS AND SPECIES FROM AN AMERICAN
MARSUPIAL.

By Launcelet Harrison, B.Sc., B.A.

Zoology Department, University of Sydney.

With 2 Figures in the Text.

Mallophaga from Australian Marsupials have been known for many years, the first having been described by Piaget in 1880, but hitherto no species has been recorded from an American marsupial. In May, 1919, I was permitted, through the kindness of Mr. Oldfield Thomas, to examine skins of some of these latter animals in the collection of the British Museum (Natural History); and was successful in obtaining from two species of *Peramys* a number of individuals of a Mallophagan species, which proved to be new and curiously interesting.

Mallophaga from Australian marsupials are contained in a family, the Boopidae, which finds its closest relations in the Gyropidae, a family found upon certain South American rodents. Certain South American rodents also harbour the two contained species of a third family, the Trimenoponidae. With the exception of these three small groups, all mammalian Mallophaga belong to the widely different family Trichodectidae, which is placed in a distinct superfamily.

Believing as I do that Mallophagan parasites afford valuable indications as to the genetic relationships of their hosts, I have always been puzzled by this distribution. That the marsupials of Australia should not carry the same kinds of parasites as the Eutherian mammals is reasonable enough. But, apart from marsupials, I should have expected all other mammalian Mallophaga to belong to the Trichodectidae. Hence the occurrence of two small, but distinct, families, not upon rodents in general, nor even upon American rodents in general, but on a limited number of South American rodent species, families which showed, moreover, some relationship with the Boopidae, but differed from all other Mallophaga, was difficult to reconcile with my ideas.

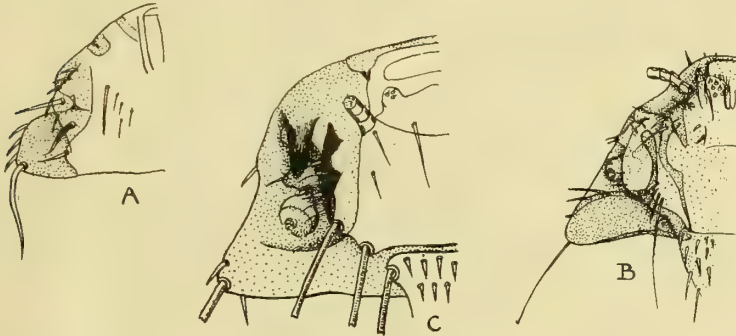
The explanation would appear to be that such Amblyceran Mallophaga as occur on South American rodents have been migrants in the past from the marsupial stock. The new genus which I describe from a South American marsupial must be placed in the Trimenoponidae, but shows some marked features of resemblance to the Boopidae, and some points of contact with the Gyropidae. It is, of course, no use trying to base definite conclusions on a single marsupial-infesting species, but it seems likely that, when more information is available concerning the Mallophagan parasites of American rodents and marsupials, the suggestion thrown out here may be upheld. It is also possible that the discovery of further connecting forms will make it advisable to unite these three anomalous groups under one family name.

FAMILY TRIMENOPONIDAE.

In my *Genera and Species of Mallophaga* (1916, p. 27), I established the family Trimenoponidae for reception of the genera *Trimenopon* and *Philandesia*, without, however, giving a diagnosis.

The Trimenoponidae may be defined as two-clawed mammal-infesting Amblycera with a spinous chaetotaxy; with reduced mandibles and modification of the mouth in the direction of a sucking organ; with head and thorax together almost as long as the abdomen and with no mesothorax visible in the mid-dorsal line; with first abdominal segment reduced, the tergite not reaching the lateral margins; and with five pairs of abdominal stigmata on segments 3-7.

As at present known, the family includes three genera, *Trimenopon* Cummings, *Philandesia* Kellogg and Nakayama, and *Acanthomenopon* now described as new. The species of these genera occur upon South American rodents and marsupials, and it is suggested that, as they do not occur upon rodents elsewhere, the family will really prove to be characteristic of American marsupials. The family is most closely related to the Boopidae, occurring on Australian marsupials, and to the Gyropidae, which are confined to South American rodents.



Text-fig. 1. Underside of head of (a) *Philandesia*, (b) *Trimenopon*, (c) *Acanthomenopon*.

Key to the Genera of Trimenoponidae.

- A. Lateral margin of head deeply emarginate *Philandesia*
- AA. Lateral margin entire.
- B. With a ventral plate partly covering the antennary fossa below
Trimenopon.
- BB. Without ventral plate, but with two broad stout spines projecting
beneath antenna *Acanthomenopon*.

Genus PHILANDESIA Kellogg and Nakayama.

Kellogg and Nakayama (1914, pp. 198-200) give a fairly detailed description and figures of the single species included in the genus, *P. townsendi*, from *Lagidium peruanum*, as well as a diagnosis of the genus. The authors' description of the mouth as "a sort of grasping tube or furrow" is not quite clear to me. The furrow spoken of is on the upper surface of the hypopharynx, and not external, as I at first took the authors to mean. Their figure might be interpreted either way, and gives no indication of the great development of chitin-

ous brushes on the anterior lobes of the hypopharynx. What the authors describe as the mesothorax is obviously the combined meso- and metathorax; while their "metathorax" really comprises the first two abdominal segments. The first abdominal segment is reduced, as in both the remaining genera of the family, and its hind margin is clearly indicated, without comment, in Kellogg and Nakayama's figure (*l.c.*, p. 198), but the lateral margins are not shown. These curve round and run straight forward to the metathoracic border, so that the tergite is narrow oblong transversely, and not crescentic as in the other two genera. The ocular emargination is described and figured as if its anterior and posterior borders were continuous in the same plane, but this is not the case. The anterior border passes backwards and downwards under the posterior to the inner limit of the antennary fossa; while the posterior border, keeping in one horizontal plane, just overlaps the anterior.

The genus may be defined as:—*Trimenoponidae* with a lateral emargination of the head, the anterior border of which passes under the posterior to the inner limit of the antennary fossa, the posterior just overlapping the anterior; with a ventral plate covering about half the antennary fossa below; with maxillary palps long, passing the head margin; with hypopharynx and pharyngeal skeleton modified to form a rounded chamber with grooved floor; with a great development of hypopharyngeal brushes; and with pads of moderate size upon the basal tarsal joints.

Genus *TRIMENOPON* Cummings.

Cummings (1913, pp. 39-41) gives an adequate description and figures of his type species, *T. echinoderma* (= *T. jenningsi* Kellogg and Paine), from *Cavia aperea*; but his generic diagnosis is brief and insufficient.

The genus may be defined as:—*Trimenoponidae* with lateral margin of head entire; with a ventral plate covering about half the antennary fossa below; with maxillary palps long, passing the head margin; with mouth parts not specially modified, but with weak mandibles; with a complex sculpture of the cuticle, resembling that seen in many *Gyropidae*; with complex ♂ genitalia; and with large pads upon the basal tarsal joints.

Genus *ACANTHOMENOPON* nov.

Trimenoponidae with lateral margin of head entire; with no ventral plate, but with two large dagger-like spines projecting beneath the antenna, one from the anterior, the other from the inner border of the fossa; with maxillary palps short, not passing the head margin; without sculpture of cuticle; with simple ♂ genitalia; and with small pads on the basal tarsal joints.

Genotype:—*Acanthomenopon horridum* Harrison.

Habitat:—Upon American marsupials of the genus *Peramys*.

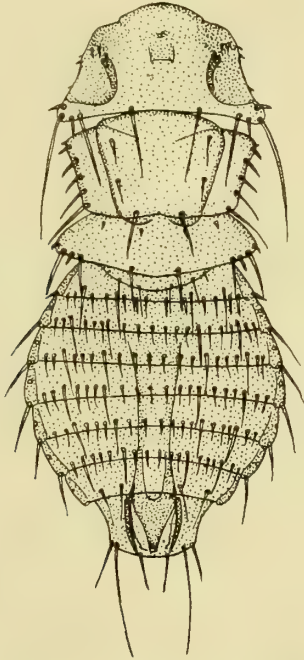
ACANTHOMENOPON HORRIDUM n.sp.

(Text-figs. 1c and 2.)

Material:—1 ♂ and 5 ♀♀ from skins of *Peramys domesticus* from Para; and 2 ♂♂ and 4 ♀♀ from a skin of *Peramys* sp. (B.M. No. 3.9.5.148) from Bahia, in the British Museum (Natural History). The specimens are not in good condition, having lost many of their hairs and, in most cases, the greater part of their legs, so the description, though based upon the types, is to a certain extent composite, particularly with regard to the chaetotaxy.

Description of ♂: Head. Almost twice as wide as long, shape best seen from Fig. 2, not so triangular as in *Philandesia* and *Trimenopon* owing to prominent bulge in frontal region; hind border slightly concave; lateral margin en-

ture; dorsal surface with no very characteristic features apart from the chitinous incrassations marking the inner limit of the antennary fossa. Undersurface (Fig. 1c) characteristic, with distinct mentum and submentum, the latter having a much raised gular portion, with strongly projecting truncated postero-lateral angles, from which arise two very long hairs. Maxillary palps short, not reaching margin of head. The antenna is four-jointed, of the usual Amblyceran type. It is partially concealed by two comparatively enormous broad-bladed spines. The first of these rises from the anterior border of the antennary fossa, and projects backwards for nearly half its length. The second is broadly based along the lateral margin of the fossa, and projects backwards along the border of the raised gular area. A minute broad-bladed spine also projects backwards from the clypeal angle.



Text-fig. ii. *Acanthomenopon horridum* ♂.

Thorax. The prothorax is roughly oblong in shape, widest at the anterior angles, tapering slightly posteriorly, and almost twice as broad as long. It comprises a central raised portion and two prominent wings. No mesothorax is visible dorsally. The metathorax is much shorter and a little wider than the prothorax, and is narrowest anteriorly, widening to the postero-lateral angles, thence obtusely rounded on the abdomen.

Abdomen. Almost as broad as long. First segment reduced to a crescentic tergite above, and a small sternite below; widest at fifth segment, thence tapering rapidly; segments 2-8 sub-equal in length, segment 9 almost twice the length and much narrower. (The concavity of its sides is exaggerated in the figure. They should be almost flat). Stigmata on the pleura on segments 3-7.

Legs. Of usual Amblyceran type, showing no signs of adaptation to mammalian habitat, except that the claws are more sharply bent than is usual in bird-infesting forms. Femur stout, with anterior border strongly arched; tibia narrow pyriform; tarsus with basal joint short, carrying a slight pad, distal joint long and curved. No marked difference between first and remaining legs.

Chaetotaxy. Head singularly free from hairs dorsally. Three small spines at anterior border of antennary fossa; three prickles along lateral border of same; a long hair flanked by two spines at temporal angle; and four evenly spaced hairs on hind margin. On the underside, there is a pair of short hairs on the mentum, a pair of spines on the submentum, and a series of six short spinous hairs on the raised gular region, in addition to the two long hairs at the postero-lateral angles already mentioned. A comb of spines projects beneath the antenna from the inner wall of the fossa.

Prothorax bears four short hairs on the raised central portion, a series of six spines, increasing in length from before backwards on the lateral margins, and a pair of hairs on the hind border. Metathorax bears a row of four prickles anteriorly, two short spines and two hairs at the postero-lateral angles, and a pair of hairs close to the mid-line on the hind border. Ventrally, the prosternite has a pair of long hairs at its antero-lateral angles, and is closely covered with small spines. The mesosternite has two long hairs laterally on either side, with three spines between. The metasternite has two irregular rows of short spines anteriorly, and a row of about five stiff hairs posteriorly.

Abdomen bears dorsally four longitudinal rows of stiff hairs, with a series of about sixteen short spines lying among them. Ventrally, there are six longitudinal rows, and interspersed with the hairs are about a dozen peg-like spines in each segment.

Genitalia. Basal plate fairly broad, extending almost to the anterior margin of segment 4, and passing backwards into a solid triangular "penis," flanked by a pair of slender, but strongly chitinous, curved parameres.

Description of ♀. Differs from ♂ only in being somewhat larger in all measurements, and in having the terminal segment of the abdomen evenly rounded, and not so elongate as in the ♂. The usual two stiff rows of hairs are placed obliquely on the gonapophyses.

Measurements in millimetres.

| | Length | Breadth | Length | Breadth |
|---|--------|---------|--------|---------|
| | | ♂ | | ♀ |
| Head | .218 | .403 | .218 | .420 |
| Prothorax | .184 | .340 | .190 | .370 |
| Metathorax | .101 | .370 | .105 | .403 |
| Abdomen from anterior angles | .520 | .504 | .571 | .554 |
| Total length and greatest breadth | 1.008 | .504 | 1.092 | .554 |

Type ♂ and allotype ♀ in the Australian Museum, Sydney, New South Wales, No. K45561; paratype material will be sent to the British Museum (Natural History), and to the Stanford University, California.

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AUSTRALIAN BLEPHAROCERIDAE.

(ORDER DIPTERA). PART 1:—DESCRIPTION OF NEW SPECIES.

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(With two Plates and seven Text-figures.)

The Blepharoceridae or Net-veined Midges are an archaic family of Nemoerous Diptera highly specialised for life in all stages on or about waterfalls and cascades. The eggs are laid singly on the faces of rocks permanently wetted with the spray of the falls, and the larva passes its whole life either in the same situations, or actually sticking to the rocks over which the water rushes. In order to be able to do this, it is provided with a set of six conspicuous mid-ventral suckers. The pupa is a black, oval object, attached firmly to the rock beneath the rushing water by three pairs of pads on its flat ventral surface, and breathing by means of two conspicuous prothoracic respiratory processes, each formed of four lamellae. The imagines have very long, slender hindlegs, and cling to the wet rocks with all six legs spread widely out. Their wings are held out at right angles to the body and in line with one another; this habit enables the collector at once to distinguish a Blepharocerid from various forms of Tipulidae which frequent similar situations, but which always rest with the wings folded down the abdomen. The secondary net-veining (Text-fig. 1) which is peculiar to this family has nothing to do with the true venation, but represents the creases formed in the wings while folded up in the pupa. It seems to have arisen because of the necessity for the imago to emerge with the greatest possible speed in order to avoid being swept away by the rushing waters; consequently, the wing has to become fully developed within the pupal shell before the imago discloses itself, and these secondary creasings are the result. Other characters of importance for the family are the frequent occurrence of holoptic eyes, and of eyes divided transversely by a non-facetted line or band into two portions, the upper of which has facets of a larger size and a different colour from those of the lower, thus closely resembling the similar eyes to be found in Ascalaphidae and certain Dragonflies. The mouth-parts are formed for piercing, particularly in the case of the females, which are furnished with long spear-like mandibles, absent in the males. The hypopygium of the males resembles that of Mecoptera and of certain Tipulidae, there being no secondary rotation of the terminal tergites and sternites through 180° , as in Psychodidae and Culicidae. The so-called superior appendages are not true appendages, but processes from the ninth ter-

gite; the longer inferior appendages, forming the forceps, are the distal segments of the gonapophyses of the ninth sternite, the basal segments forming the "side-pieces" or bases of the forceps, while the true ninth sternite is reduced to a narrow ring. A penis and a pair of penunci are also present, though mostly hidden between the upper processes and the forceps. In the female, the abdomen ends in a pair of short appendages, while the ninth sternite bears a pair of small gonapophyses, unsegmented.

A constant feature in the wings of this family is the general shape of the wing, which is petiolate at the base, the narrow portion being called the *petiole* or *pedicel*, and then widens out suddenly by enlargement of the anal margin, so that a deep re-entrant angle is formed between the pedicel and the rest of the wing; this is called the *axillary lobe*. The anal margin then becomes strongly bent into a projecting angle, generally a right-angle or slightly obtuse, more rarely somewhat acute, and called the *anal angle*. Closely allied species may have considerable differences in the form of this angle as reliable specific characters.

The venation of most Blepharoceridae is so reduced that the naming of the veins has until recently been open to considerable doubt. But the discovery, in Southern Chile and Patagonia, of the archaic genus *Edwardsina*, recently described by Alexander, has definitely solved this problem; for, in this genus, the venation is complete enough to enable all the main veins to be named with certainty, as may be seen from Text-fig. 1, a.

Though abundant enough in New Zealand, from which region four species have already been described and others still await description, yet the record of the occurrence of Blepharoceridae in Australia rested until recently on a single specimen taken by Mr. F. P. Dodd at Kuranda, N. Queensland, and described by Professor Bezzi as *Apistomyia collini* in *Bull. Soc. Entom. Ital.*, xlv. (1912), 1913, pp. 67-69. Having collected these interesting insects abundantly in many parts of New Zealand, and being familiar with their peculiar life-histories, it occurred to me that their apparent absence in such places as the Blue Mountains of N.S.W. might be explained most satisfactorily by the fact that they had been consistently overlooked by collectors, rather than that they were actually absent from such favourable localities. Therefore, on a recent visit to Sydney, I determined to make special search for them. This search was rewarded by my finding, on the very first day of my visit to Wentworth Falls, numerous larvae and pupae of a Blepharocerid on and around the Weeping Rock. On the following day, which was sunny, imagines of both sexes of this new species were taken in the same locality. A week or two later, while on a visit to Mount Kosciusko, two fine new species were secured, together with larvae and pupae. Thus the total number of species for Australia has already been brought up to four as the result of only a few days collecting in suitable localities. It would seem reasonable to suppose that many more species of these interesting flies remain to be discovered throughout Tasmania, where waterfalls are plentiful, and also in the mountainous parts of the Australian mainland.

The present paper will deal only with the imagines of the newly discovered species. Later on, I hope to give, in a second paper, full descriptions of the larvae and pupae, together with some account of their habits, and a discussion of the value of the larval characters as guides to generic affinities.

The three species here described belong to three different genera, viz., *Edwardsina* Alex., *Neocurupira* Lamb. and *Apistomyia* Bigot. The first of these has only been previously recorded from Southern Chile and Patagonia, so that the existence of such an archaic type on Mount Kosciusko is striking additional evidence on the question of ancient land-connections between Southern land-

masses of the present day. In all stages of their life-history, Blepharoceridae are dependent on the rushing water and spray of waterfalls, and are quite unable to exist for more than a very short time without these. Hence their distribution cannot have been brought about by sea or air carriage, but must have taken place along definite land routes marked by the frequent occurrence of running streams; and this, of course, indicates land of a mountainous nature. The morphology of the family would indicate for it an origin in either Liassic or Upper Jurassic times. Thus the presence of a species of *Edwardsina* on Mount Kosciusko is best explained by the Antarctic Theory, which postulates that, at some ancient time or other, but not necessarily at the same time, Australia and Tasmania together, and New Zealand and Patagonia separately, were all linked with the Antarctic Continent when it enjoyed a temperate climate, and thus allowed of the passage of many types of plants and insects from one to the other of these regions. If this theory be correct, it may reasonably be expected that another species of *Edwardsina*, or of some closely allied new genus, will be discovered in the high mountains of Tasmania.

The other genus discovered on Mount Kosciusko is *Neocurupira* Lamb., found only hitherto in New Zealand, and also related to *Curupira* from Brazil. This genus also may be expected to occur in Tasmania. It is considerably more highly specialised than *Edwardsina*.

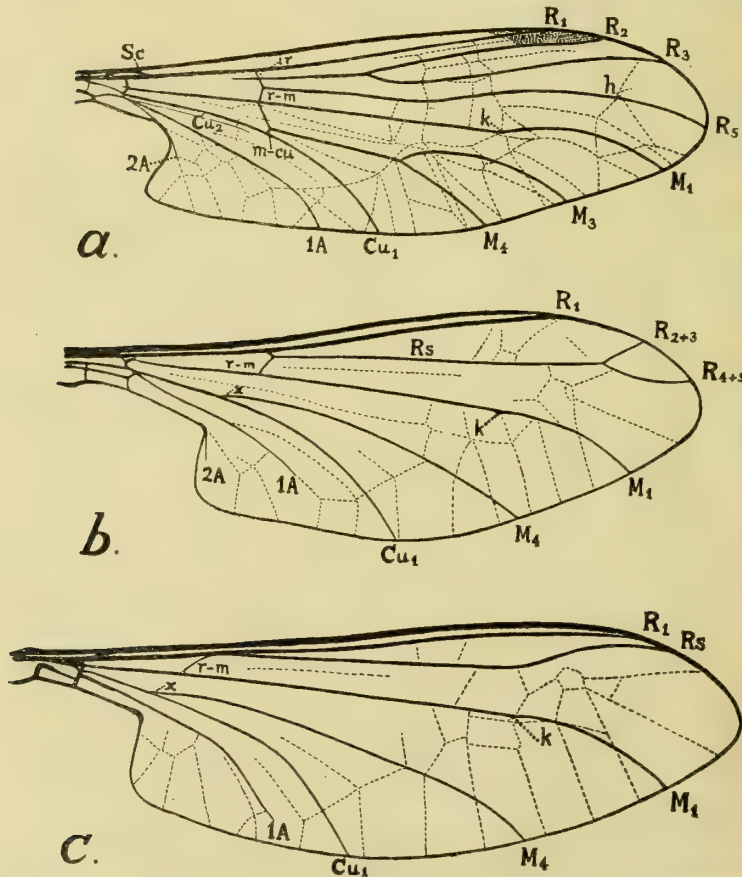
The genus *Apistomyia* Bigot, to which the new species found at Wentworth Falls belongs, is represented by species found in Corsica, Cyprus, the Himalayas and North Queensland, and will probably be found to exist in all suitable localities right through the Oriental Region and across to New Guinea as well as down the Eastern Coast of Australia. It is absent from New Zealand, Campbell's *Apistomyia harrisi*, recently described, (*Trans. N.Z. Inst.*, liii., 1921, p. 262), being undoubtedly a true *Peritheates*, and this latter genus being so far unknown outside New Zealand. It is more highly specialised than *Neocurupira*. Thus, as we pass from South to North along the Eastern ranges of Australia, we meet first with the more archaic types, and then with the more highly specialised. This, again, suggests a Southern origin for the family in Australia. New Zealand, likewise, on present evidence, has only received types from the South; and the comparative much greater abundance of these insects in the South Island than in the North also bears this out.

Bezzi has divided the family Blepharoceridae into four subfamilies, I have not adopted these, and do not think it necessary to discuss them, as it seems to me very clear that such divisions are very unwise in the present state of our knowledge, and that much more work needs to be done on the family before the main lines of evolution within it can be made clear. Until that is done, preconceived opinions of relationships of genera, based on their supposedly belonging to one or other of Bezzi's subfamilies, only prevent a clear view of the field, and are apt to bias or predispose one's judgment in the matter. What is perfectly clear is that *Edwardsina* is easily the most archaic genus so far discovered, and that the archetype of the family was not far removed from this type. Consequently, all known genera can be derived from a type not unlike *Edwardsina*; but how many separate lines of descent there are actually represented by living forms at the present day, we cannot say for certain. A careful study of larval and pupal characters may help us to solve this problem; but the principal characters for each genus must always be drawn from the imago, as has hitherto been done by all workers in the group.

In the following Key to the Genera, I include the New Zealand genus *Peritheates* Lamb, as it seems likely that it too may yet be discovered in Australia or Tasmania.

KEY TO THE GENERA OF BLEPHAROCERIDAE FOUND IN
AUSTRALIA, WITH THE ADDITION OF *PERITHEATES* Lamb.

- Maxillae with long, four- to five-segmented palpi; antennae long; eyes
not divided transversely into upper and lower portions; wings with Rs
and M both three-branched *EDWARDSINA* Alex.
- (1) { Maxillae with short, one- to two-segmented palpi; antennae short; eyes
divided transversely into upper and lower portions; wings with Rs simple
or having a terminal fork, media with only M_1 and M_4 present 2.
- (2) { Rs with a terminal fork *NEOCURUPIRA* Lamb.
Rs simple 3.
Rs nearly straight, ending up far from R_1 , just above apex.
- (3) { *PERITHEATES* Lamb.
Rs curving sharply upwards distally, so as to end up very close to R_1 ,
far from apex *APISTOMYIA* Bigot.



Text-fig. 1:—Wings of *a*, *Edwardsina australiensis* n.sp., ♂, (x 11), *b*, *Neocurupira nicholsoni* n.sp., ♂, (x 16), *c*, *Apistomyia tonnoiri*, n.sp., ♀ (x 21).

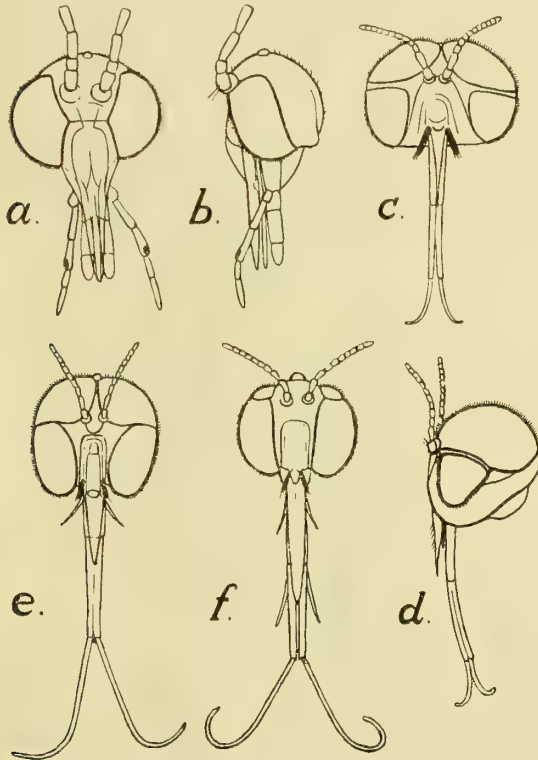
Genus EDWARDSINA Alex.

(Text-fig. 1, a.)

Alexander, C.P., *Arkiv för Zoologi*, Bd. 13, No. 7, 1920, p. 2.

Characters as given in the Key, with the following additions:—eyes dichoptic in both sexes; mandibles in the female rather broad, knife-shaped; labium of primitive Mecopterous form, with separate, two-segmented palps of broad form and with well rounded apices, forming a primitive type of labellum; all three pairs of legs long; wings with a long fork to R_{2+3} , M_2 indicated either by a stump-vein or a definite kink in M_{1+2} , M_{3+4} broadly forked distally, and connected basally with M_{1+2} by its original basal piece, as well as to Cu_1 by *m-cu*; pedicel short and anal angle prominent.

Genotype:—*E. chilensis* Alex. (Southern Chile and Patagonia).



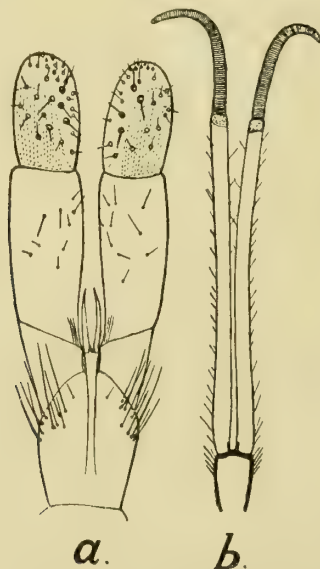
Text-fig. 2:—Heads of *a*, *Edwardsina australiensis* n.sp., ♀, (x 20), front view, *b*, the same, side view, *c*, *Neocurpira nicholsoni* n.sp., ♂, (x 20), front view, *d*, the same, side view, *e*, *Apistomyia tonnoiri* n.sp., ♂, (x 20), front view, *f*, the same species, ♀, front view.

EDWARDSINA AUSTRALIENSIS n.sp.

(Plates xlv., figs. 1, 2; xlv., figs. 1-7, a; Text-figs. 2, a, b; 3, a; 4).

♂. Total length 5, abdomen 3, forewing 9.5, expanse 20 mm.

Head small, subglobular, dull blackish in colour, with greyish pubescence. Occiput prominent; vertex with a small but conspicuous ocellar tubercle placed between the inner posterior angles of the eyes and surrounded by a pale raised ring. Median ocellus large, bright, facing forwards, lateral ocelli smaller, facing laterally outwards. Eyes dichoptic and undivided, separated from each other by the trapezium-shaped vertex, which narrows anteriorly to about the width of the ocellar tubercle; colour dull blackish. Antennae (Plate xlv., fig. 1 a and text-fig. 2, a, b) inserted fairly close together, 3.2 mm. long, with 15 segments; colour black; the two basal segments short and somewhat swollen, the rest longer, sub-cylindrical, somewhat flattened; the first segment carries two stiff bristles, the others only a very few short hairs; last four segments narrower than the rest, terminal segment somewhat pointed at apex. Labrum-epipharynx (Plate xlv., fig. 2 a) somewhat broader than usual in the family, the sides almost parallel, the tip broadly rounded, colour dark brown. Hypopharynx of about the same length as labrum, but narrower, the tip more pointed, the sides carrying minute barbs. Mandibles absent. Maxillae (Plate xlv., fig. 3, a) with long (1 mm.), five-segmented palpus, and with small, pale coloured, rather weakly formed galea, sharply pointed at apex; the palpus blackish, densely clothed with greyish hairs; first segment of palp very short, bulbous, closely attached to the palpiger; second segment long and slender; third not so long, somewhat enlarged distally, and carrying a conspicuous dark-coloured sense-organ (so) close up to apex on outer side; this sense organ is of oval shape, and appears to be divided into three



Text-fig. 3:—Labium of *a*, *Edwardsina australiensis* n.sp., ♀, (x 100), *b*, *Neocurupira nicholsoni* n.sp., ♂, (x 50).

sub-equal sectors; fourth segment slender cylindrical, two-thirds as long as second; fifth segment narrower and slightly longer than fourth, rounded at apex. *Labium* (Text-fig. 3a) not quite as long as labrum, of very primitive form, resembling that of certain Mecoptera; arising from a moderately broad basal piece (probably the mentum) there is a very narrow median lobe carrying two very small sharply pointed processes, representing the inner lobes; on either side of these lie the broad palpigers, from each of which arises a large two-segmented palpus of typical Mecopterous form, the basal segment being the larger and paler, somewhat less heavily chitinised than the apical, and carrying only small slender setae, while the apical segment has a broadly rounded tip and carries numerous short stiff sensory setae arising from wide circular bases; the two palpi, though separated for their entire lengths, clearly constitute a true *labellum* of primitive type.

Thorax of the usual shape for the family, the *prothorax* very small, the *mesothorax* greatly swollen, the *metathorax* small, with the *scutellum* in the form of a slightly projecting convex ridge. Colour velvety black with greyish pubescence; *scutellum* shining black. Sides of thorax dull blackish, with a pale testaceous area situated beneath the attachment of the wing on each side.

Legs all very long; coxae and trochanters very short, testaceous, each with a conspicuous tuft of stiff black hairs beneath it; femora, tibiae and tarsi very long, the hind femur stoutly built; colour black, except the bases of the femora, which are testaceous. Measurements as follows:—

Foreleg:—Femur 6, tibia 6, tarsus 5.8 mm.

Middle leg:—Femur 6, tibia 5.4, tarsus 5.2 mm.

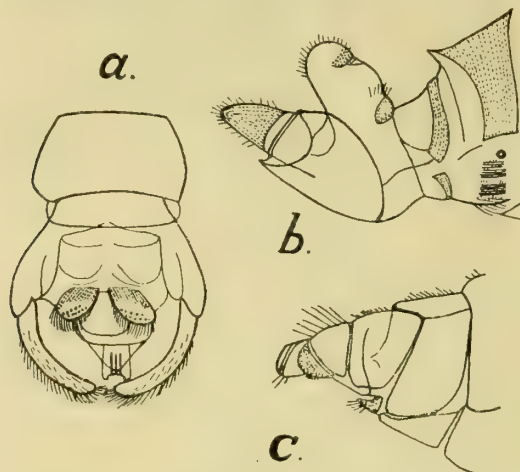
Hind leg:—Femur 8.5, tibia 8.5, tarsus 3.8 mm.

Middle and hind tibiae with a single long black spur (Plate xlv., fig. 5, a). **Hind tarsus** (Plate xlv., fig. 6, a.) with the basal segment as long as the other four plus the claws; length of segments in order, 1, 2, 5, 3, 4, (5 almost equal to 3); segs. 1-4 very narrow, cylindrical, 5 enlarged basally and slightly curved, its base beset with numerous stiff bristles, its outer margin hairy. **Tarsal claws** (Plate xlv., fig. 7, a.) curved, sharply pointed, carrying on the inner side four prominent teeth, of which the first is smaller than the others and placed close up to the second; *empodium* apparently very rudimentary.

Wings:—*Forewings* subhyaline, slightly infuscated all over, with black venation and a beautiful violet iridescence; pterostigma darkened. Venation and secondary net-veining as shown in Text-fig. 1, a. The wings differ from those of the genotype (*E. chilensis* Alex.) in being somewhat narrower in proportion to their length, with the anal angle more prominent, the fork of R_{2+3} placed further distad (half-way from base in *E. australiensis*, one-third from base in *E. chilensis*), the basal stump of Rs shorter, R_{4+5} originating immediately below *ir*, *m-cu* very short (almost obsolete in some specimens), the basal stump of M₂ absent, though the kink (*k*) in the vein M_{1+2} , at the point where M₂ originally came off, remains; Cu₂ is closer to Cu₁ than in *E. chilensis*, 1A diverges from Cu₁ distally, and 2A is complete from base to axillary lobe, and runs a little beyond it. At the point *h* in Text-fig. 1, a, there is, in a few specimens, a definite stump-vein projecting upwards and distad; this is evidently the stump of an original R₄, and indicates that the single vein hitherto taken to be R_{4+5} is, as far as its distal portion is concerned, really only R₅, R₄ having been eliminated. The posterior margin of the wing carries a fringe of fine hairs from base to apex, those on the pedicel being the longest.

Halteres 1.2 mm. long; pedicel slender, testaceous at base but darkening distally; club broadly spatulate, black, with a small area of pale testaceous basally.

Abdomen slender subcylindrical, the hypopygium distinctly upturned. Colour dull blackish above fading to brownish below. Each segment is furnished with a tuft of blackish hairs on either side.



Text-fig. 4:—*Edwardsina australiensis* n.sp. *a*, Hypopygium of ♂, dorsal view (x 50). *b*, the same, lateral view. *c*, end of abdomen of ♀ (x 20).

Hypopygium as shown in Text-fig. 4, *a*, *b*.

♀. Forewing 11.5, expanse 24.5 mm. Measurements of hindleg:—femur 9.7, tibia 9.7, tarsus 4 mm. Differs from the male as follows:—

The head (Text-fig. 2 *a*, *b*) is larger and more squarely shaped, the occiput very broad, as wide as the total width across the eyes, cut off squarely behind, but with the lateral posterior angles slightly rounded off. Eyes somewhat smaller than in male and separated by a somewhat wider space. (Text-fig. 2, *a*, *b*). Antennae 2.8 mm. long. Margin of occiput behind eyes greyish white. Mandibles (Plate xlv., fig. 4, *a*) present, 1.3 mm. long, knife-shaped, with slightly nodding apex ending in a fine tooth; inner margin finely serrated for apical two-thirds of its length, the fine teeth all being turned backwards towards the base.

Abdomen tapering distally, broader than in male, ending in a pair of short appendages cut off obliquely as shown in Text-fig. 4, *c*; gonapophyses of seg. 9 very small, pointed, hairy.

Types:—♂ holotype, ♀ allotype, and series of paratypes of both sexes, in Cawthron Institute Collection, Nelson, N.Z. A pair of paratypes in British Museum of Natural History, London, and another pair in the Australian Museum, Sydney.

Habitat:—Waterfalls along Digger's Creek, from 4500 to 5500 feet, on Mount Kosciusko, N.S.W. Types taken at a little over 5000 feet on Nov. 25th, 1921, paratypes, Nov. 24th to 28th inclusive.

This remarkable insect occurs fairly abundantly wherever a small waterfall offers sufficient rush of water for the existence of its larvae and pupae. It clings to the edges of rocks over which the water is rushing, or to the damp moist surfaces of rocks and crevices placed so close to the main rush of water that they are drenched with the spray. Several pairs were seen in cop. in such

localities, and it seems certain that the eggs are laid also in similar places. A female placed inside a damp glass tube oviposited readily, the eggs being placed singly. The flies themselves are very tame, and can easily be caught either with a forceps or with the fingers, though they should be approached without unnecessarily irregular movements. The flight is ghostlike, and the insects are not easy to see as they drift up against the white foam of the waters. In sunlight, the violet iridescence of the wings is exceedingly beautiful, and often betrays the presence of the insect when clinging to a rock in the spray of a waterfall.

Larvae and pupae were abundant, but difficult to locate, owing to the dark colour of the granite rocks forming the bed of the creek. Numbers were finally collected by temporarily damming the stream so as to leave portions of the rocks nearly dry, and then picking the larvae and pupae off them.

The male of this fly is shown enlarged in Plate xlv., fig. 1, the female in fig. 2. One female was taken which expanded just an inch across the wings,—a large size for this family.

E. chilensis Alex. differs from *E. australiensis* n.sp. not only in the venational characters already mentioned, but also in having spurs 1, 2, 2 instead of 0, 1, 1. Alexander also says that the maxillary palps are 4-segmented, but he has probably overlooked the very short basal segment.

Genus NEOCURUPIRA Lamb.

Lamb, *Trans. N.Z. Inst.*, xlv., (1912), 1913, p. 72, figs. 1-5.

Characters as given in the Key on p. 162, with the following additions:—antennae 12- to 15-segmented; eyes holoptic in the male, diehoptic in the female; labium very long and narrow, with the distal segments of the labellum strongly divergent; fore and middle legs rather short, hind legs very long; spurs 0, 0, 2; anal angle of the wing prominent.

Genotype:—*Neocurupira hudsoni* Lamb, (Arthur's Pass, South Island of New Zealand).

NEOCURUPIRA NICHOLSONI n.sp.

(Plates xlv., fig. 3; xlv., figs. 1-3, 5-7, *b*; Text-figs. 2, *c*, *d*; 3 *b*; 5.)

♂. *Total length* 3, *abdomen* (shrivelled) 1.6, *forewing* 6, *expanse* 12.5 mm.

Head (Text-fig. 2 *c*, *d*.), large, black, globular, almost entirely occupied by the large *eyes*, which are bright green in life, dull blackish when dead, and often collapsed in the dried specimen; these eyes are holoptic, and each is divided transversely by a non-faceted band into two approximately equal portions, the upper having larger facets than the lower. A fringe of pale brown hairs borders the orbits above and behind. *Ocellar tubercle* small. *Antennae* (Plate xlv., fig. 1 *b*) inserted close together at the base of the narrow triangular vertex, short (0.8 mm.), black, 12-segmented, the two basal segments enlarged, the second club-shaped and longer than the first, 3 much shorter and narrower than 2, 4-7 each a little shorter than the one before it, 8-10 subequal, little longer than wide, 11 very short and closely attached to 12, which is longer, with well rounded tip carrying two stiff bristles. *Labrum-epipharynx* (Plate xlv., fig. 2 *b*) 0.6 mm. long, slender triangular, the tip sharply pointed. *Hypopharynx* about the same length, narrower, tip not so pointed. *Mandibles* absent. *Maxillae* (Plate xlv., fig. 3, *b*.) with a single-segmented palpus of same length as the galea (0.3 mm.), the palp subcylindrical with rounded apex, hairy, black, the galea very slender, sharply pointed, pale in colour. *Labium* (Text-fig. 3, *b*) very long (1.4 mm.), slender, black, projecting downwards one and a half times the whole diameter of the head; labellum with basal segments very long, closely approximated, distal segments shorter, their distal portions curving outwards.

Thorax velvety black, with two patches of slight greyish pubescence on either side of the mesonotum and a touch of brown just above the wings; *scutellum* black, convexly rounded.

Legs:—Forelegs rather long, middle legs shorter, hindlegs very long. Coxae and trochanters short, brownish; femora, tibiae and tarsi long, the femora very slightly enlarged distally, brownish at base shading to blackish distally, tibiae and tarsi brownish. Measurements as follows:—

Foreleg:—Femur 1.5, tibia 2, tarsus 2.8 mm.

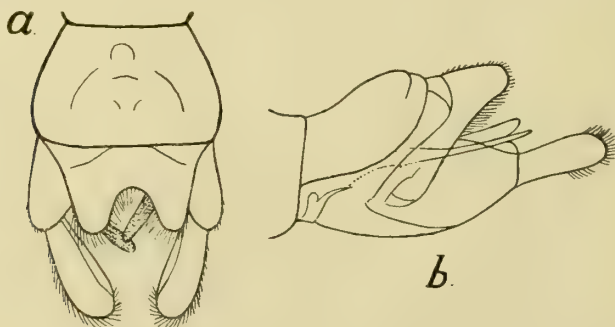
Middle leg:—Femur 1.5, tibia 1.5, tarsus 1.7 mm.

Hind leg:—Femur 3.4, tibia 3.4, tarsus 4 mm.

Fore and middle tibiae and tarsi very narrow cylindrical; those of hind leg distinctly broader, with segments 2-4 of tarsus somewhat fusiform, 5 slender (Plate xlv., fig. 6, *b*). *Hind tibia* with two small slender black spurs (Plate xlv., fig. 5, *b*), one a little shorter than the other. Order of length of segments of hind tarsus, 1, 2, 3, 5, 4; no spines present, and only very minute soft hairs. *Tarsal claws* (Plate xlv., fig. 7, *b*.) curved, sharply pointed, the inner side carrying no teeth, but convexly curved and having a series of fine, closely set hairs along its middle third; empodium curved, subtriangular, about two-fifths as long as claw.

Wings:—*Forewing* (Text fig. 1, *b*) subhyaline, slightly infuscated all over; venation black except Rs and M, which are brownish. C and R₁ stout, forming a strong anterior border to the wing. Venation almost exactly the same as in the genotype *N. hudsoni* Lamb, the only differences being that 1A fails to reach the wing-margin and 2A passes well beyond the little chitinous patch on the axillary lobe. (N.B. The venation of the pedicel of the wing of *N. hudsoni*, as given by Lamb in *Trans. N.Z. Inst.*, vol. xlv., 1913, p. 72, fig. 4, is incorrect; it should more closely resemble that shown in my Text-fig. 1, *b*). At the point *k* there is a slight kink showing where M₂ originally came off from M₁₊₂. The point *x* indicates the secondary attachment of M₄ to Cu₁ by means of the cross-vein *m-cu*, the original basal piece of M₃₊₄ having become obsolete (cf. *Edwardsina*, Text-fig. 1, *a*). *Halteres* 1 mm. long, with swollen brownish base, blackish pedicel, and blackish subtriangular club.

Abdomen slender cylindrical, hairless, velvety black with slight brownish-grey pubescence; no markings. *Hypopygium* upturned, shaped as shown in Text-fig. 5, *a*, *b*, the superior processes and forceps black, with pale hairs.



Text-fig. 5:—*Neocurupira nicholsoni* n.sp. *a*, Hypopygium of ♂, dorsal view. *b*, the same, lateral view (x 50).

♀, (unique), differs from ♂ only in its slightly larger size (expanse 13.5 mm.) and in the following characters:—*Head* smaller, with much smaller blackish eyes, dichoptic but divided transversely; *mandibles* present. *Abdomen* much stouter than in ♂, tapering apically, blackish with plentiful grey pubescence, and ending in a pair of small, bluntly cornute appendages. The wings, damaged by immersion in water, appear to be somewhat more deeply infuscated than in the ♂.

Types:—♂ holotype, ♀ allotype and short series of male paratypes in Cawthron Institute Collection, Nelson, N.Z. A single paratype male in British Museum of Natural History, London, and another in the Australian Museum, Sydney.

Habitat:—Only found on the large waterfall on Digger's Creek, Mount Kosciusko, 4500 feet, about two miles below the hotel, and on the rapids round about it. November 28th, 1921; ten males taken by myself, and a single female found half-drowned by Mr. A. J. Nicholson. Larvae and pupae were plentiful on the rocks over which the water was running or the spray dashing heavily. The males were caught drifting up stream in sunlight along the rapids above the falls; they are very difficult to see. When alive in the pill-box, their large green eyes glow brilliantly, like those of Tabanids and certain dragonflies. One male was beaten from a bush overhanging the rapids. There is no iridescence on the wings.

This species is dedicated to Mr. A. J. Nicholson, B.Sc., F.E.S., Lecturer in Entomology in the University of Sydney, who accompanied me to Mount Kosciusko and himself took the only known female of this insect.

Genus APISTOMYIA Bigot.

(Text-fig. 1, c.)

Bigot, *Ann. Soc. ent. France*, (4), ii., 1862, pp. 109-114, pl. 1.

Characters as given in the Key on p. 162, with the following additions:—*antennae* only ten-segmented; eyes holoptic in the male, dichoptic in the female; labium very long and narrow, with the distal segments of the labellum strongly divergent; fore and middle legs rather short, hind legs long; spurs 0, 0, 2; anal angle of the wing prominent.

Genotype:—*Apistomyia elegans* Bigot (Corsica and Cyprus).

APISTOMYIA TONNOIRI n.sp.

(Plates xlv., fig. 4; xlv., fig. 1-7, c; Text-figs. 2, e, f; 6; a-c; 7).

♂. *Total length* 5.5, *abdomen* 4, *forewing* 5.5, *expanse* 12 mm.

Head (Text-fig. 2, e.) large, black, globular, almost entirely occupied by the large eyes, which are bright green in life, dull blackish when dead, and sometimes collapsed in the dried specimen; these eyes are holoptic, and each is divided transversely by a non-faceted line into two approximately equal portions, the upper having larger facets than the lower. *Ocellar tubercle* very small. *Antennae* (Plate xlv., fig. 1, c.) inserted fairly close together at the base of the narrow triangular vertex; short (0.7 mm.), black, 10-segmented, the two basal segments enlarged, the second longer than the first, the third much slenderer and only two-thirds as long as the second, 4-9 short, nearly equal, each about as wide as long, 10 nearly as long as 2, more than twice as long as 9, elongate oval with well rounded apex, 2-10 with very fine hairs. *Face* with silver-grey pubescence and hairs. *Labrum-epipharynx* about half as long as the basal segment of the labium, moderately broad, tip sharply pointed. *Hypopharynx* a little shorter, much slenderer, more sharply pointed. *Mandibles* absent. *Maxillae* (Plate xlv.,

fig. 3, c.) with a very short, slender and slightly curved black palpus, consisting of a single segment, and carrying a few hairs, and with a slender, pale coloured and sharply pointed galea, twice as long as the palp. *Labium* (Text-fig. 2, e, f.) very long and slender, black, projecting downwards and backwards more than twice the whole diameter of the head; labellum with basal segments closely approximated and connected by membrane, the distal segments diverging widely and with the distal portions curving outwards, more so in ♀ than in ♂.

Thorax velvety black, with silvery-grey markings similar to those shown in Text-fig. 7 for the female, but less conspicuous and narrower; suture between mesonotum and mesopleura more widely marked in the same colour; *scutellum* black, convexly rounded.

Legs:—Fore and middle legs rather short, the middle shorter than the fore, hind very long. Coxae and trochanters short, silvery grey pubescent; femora, tibiae and tarsi long, black; distal halves of fore and middle femora somewhat swollen, those of hind femora only slightly so. Measurements as follows:—

Foreleg:—Femur 1.5, tibia 2.3, tarsus 2.8 mm.

Middle leg:—Femur 1.5, tibia 1.7, tarsus 1.7 mm.

Hind leg:—Femur 4.5, tibia 4.5, tarsus 4 mm.

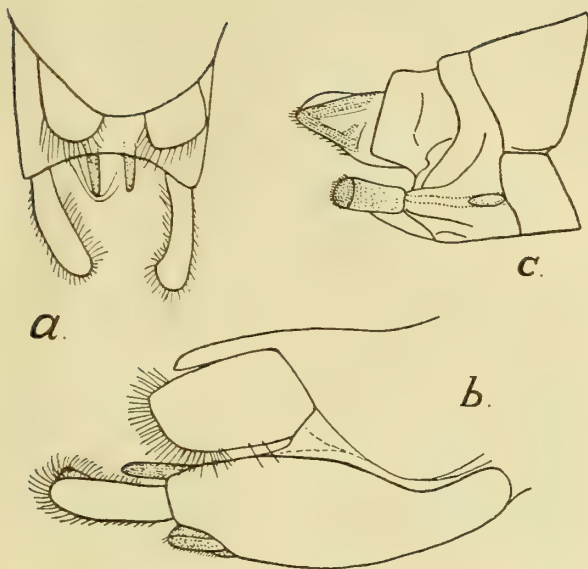
Hind tibia (Plate xlv., fig. 5, c.) with two equal black spurs. *Hind tarsus* (Plate xlv., fig. 6, c.) with the segments very long and slender, narrowly cylindrical, 1 nearly twice as long as 2; order of length of segments 1, 2, 3, 4 = 5. Inner margin of 1 bears about ten small spines, that of 2 four similar spines, and that of 3 and 4 one each. *Tarsal claws* (Plate xlv., fig. 7, c.) curved, black, sharply pointed, carrying on inner side about eight strong teeth, all set closely together on basal two-thirds. *Empodium* well developed, slender, about one-third as long as claw.

Wings:—*Forewing* (Text-fig. 1, c.) hyaline without the slightest infuscation; C and R₁ stout, jet black, forming a very strong anterior border to the wing; venation black. Venation and secondary net-veining as shown in Text-fig. 1, c. The venation differs from that of other members of the genus in having the short stalk of Rs from R to r-m obliterated, while r-m itself runs from M forwards as a strong oblique vein ending anteriorly on R, just before the apparent origin of Rs. Distal curvature of Rs (typical of the genus) well marked. About three fourths of the way along M₁₊₂ there is always a very slight but more or less clearly marked kink (k), indicating the point where M₂ originally came off. The point x marks the secondary origin of M₄ from Cu₁, brought about by the suppression of the original basal piece of M₃₊₄ and its union with m-cu; this point is situated only very slightly distad from the level of the axillary lobe. 1A fails to meet the wing-margin. The secondary net-veining is on the same general plan as that of *Neocurupira* and *Peritheates*, but very different from that of *Edwardina*. *Halteres* 1 mm. long, with blackish swollen base, slender brownish pedicel, and black spatulate club.

Abdomen slender cylindrical, hairless, velvety black; seg. 1 with a transverse band of silver, complete, but very narrow mid-dorsally; 2-5 with conspicuous basal lateral silvery spots, not connected across the dorsum, rest black; sides of abdomen covered with silvery grey pubescence, underside brownish. *Hypopygium*, upturned, shaped as shown in Text-fig. 6, a, b, the superior processes and forceps black and hairy.

♀ slightly larger than ♂, *forewing* 6.5, *expanse* 14, *hindleg* 14 mm.

Differs from the ♂ as follows:—*Head* smaller (Text-fig. 2, f.), the eyes dull blackish, dichoptic, separated above by a space as broad as their combined widths; *eyes* divided transversely by a non-faceted line which cuts off a very small upper and very large lower portion; *ocellar tubercle* larger than in ♂; a



Text-fig. 6:—*Apistomyia tonnoiri* n.sp. *a*, Hypopygium of ♂, dorsal view ($\times 100$). *b*, the same, lateral view. *c*, end of abdomen of ♀, lateral view ($\times 50$).

large inverted U-shaped mark of silver on vertex and two small silver dots, one behind each eye, on occiput; *face* strongly marked with silver grey. *Labrum-epipharynx* and *hypopharynx* (Plate xlv., fig. 2, *c*.) half as long again as in ♂. *Mandibles* present (Plate xlv., fig. 4, *c*.), 1.2 mm. long, exceedingly slender, spear-like, sharply pointed, and carrying minute forwardly projecting barbs on the inner margin. *Abdomen* cylindrical, broader than in ♂, apex downcurved and slightly pointed; colour velvety black with the same type of pattern in silver as in ♂, but the markings larger and more conspicuous, as shown in Text-fig. 7; seg. 1 with the lateral basal spots not connected across the dorsum; seg. 6 with two silver spots. End of abdomen with a pair of subconical appendages, as shown in Text-fig. 6, *c*; *gonapophyses* of seg. 9 rather large, subconical, with dark, rounded apices carrying numerous minute hairs.



Text-fig. 7:—*Apistomyia tonnoiri* n.sp., ♀, colour pattern ($\times 11$).

Types:—♂ holotype, ♀ allotype and four paratypes in Cawthron Institute Collection, Nelson, N.Z.; also a single paratype ♀ in British Museum of Natural History, London.

Habitat:—Weeping Rock and waterfalls below it, Wentworth Falls, Blue Mountains, N.S.W., 2800 feet. Larvae and pupae were found by myself in fair numbers on Nov. 17th, 1921. The type series of imagines was taken on Nov. 18th in the same locality, the females by myself as they drifted up against the spray of the falls or alighted on the wet rocks, the males a little later on the same day by M. Tonnoir, who accompanied me, and who observed them flying high up in bright sunshine in the spray of the waterfall, just like tiny Mayflies. Males were fairly abundant, but almost all out of reach of the net, being fifteen to twenty feet up in the air. In life, the eyes of the male glow in brilliant green, like those of *Neocurupira nicholsoni* n.sp.

This species differs from *Apistomyia collini* Bezzi, found in North Queensland, (*Bull. Soc. Entom. Ital.*, xliv., [1912], 1913, pp. 67-69), in the wings being purely hyaline instead of "slightly infuscated, with the apical spot reduced to a slight grey border," in the condition of *r-m* being fused above with R, the basal piece of Rs being absent, and also in the abdominal pattern, the silver markings not being joined as transverse bands across the dorsum as they are in *A. collini*. It appears to agree fairly closely with *A. collini* in the form of the antennae.

I dedicate this species to M. Tonnoir, the well known Belgian Dipterist, who accompanied me to the Blue Mountains on the occasion of its discovery, and himself discovered the males of the species.

In concluding this paper, I desire to express my thanks to Mr. W. C. Davies, Curator of the Cawthron Institute, for the excellent photograph of these delicate flies from which Plate xlv. has been prepared.

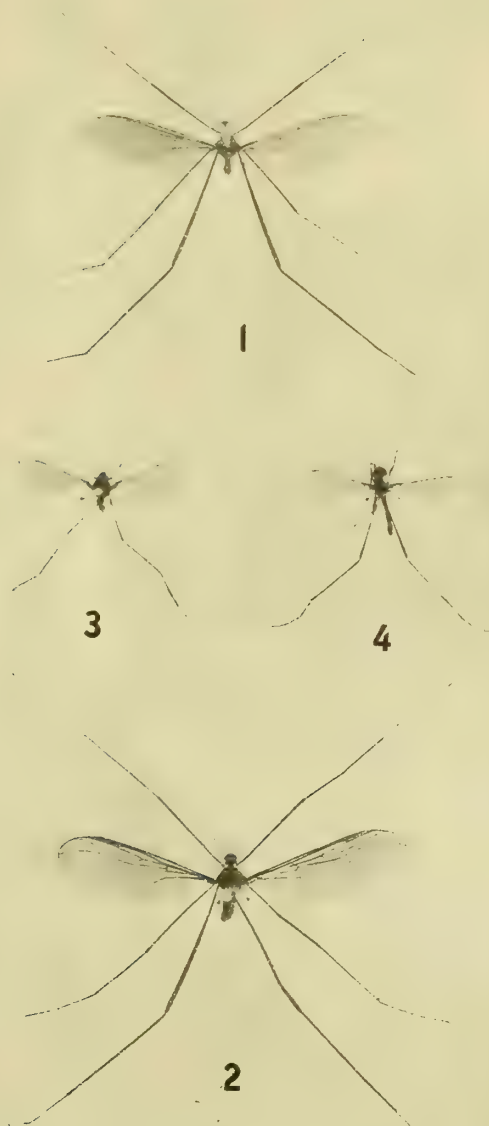
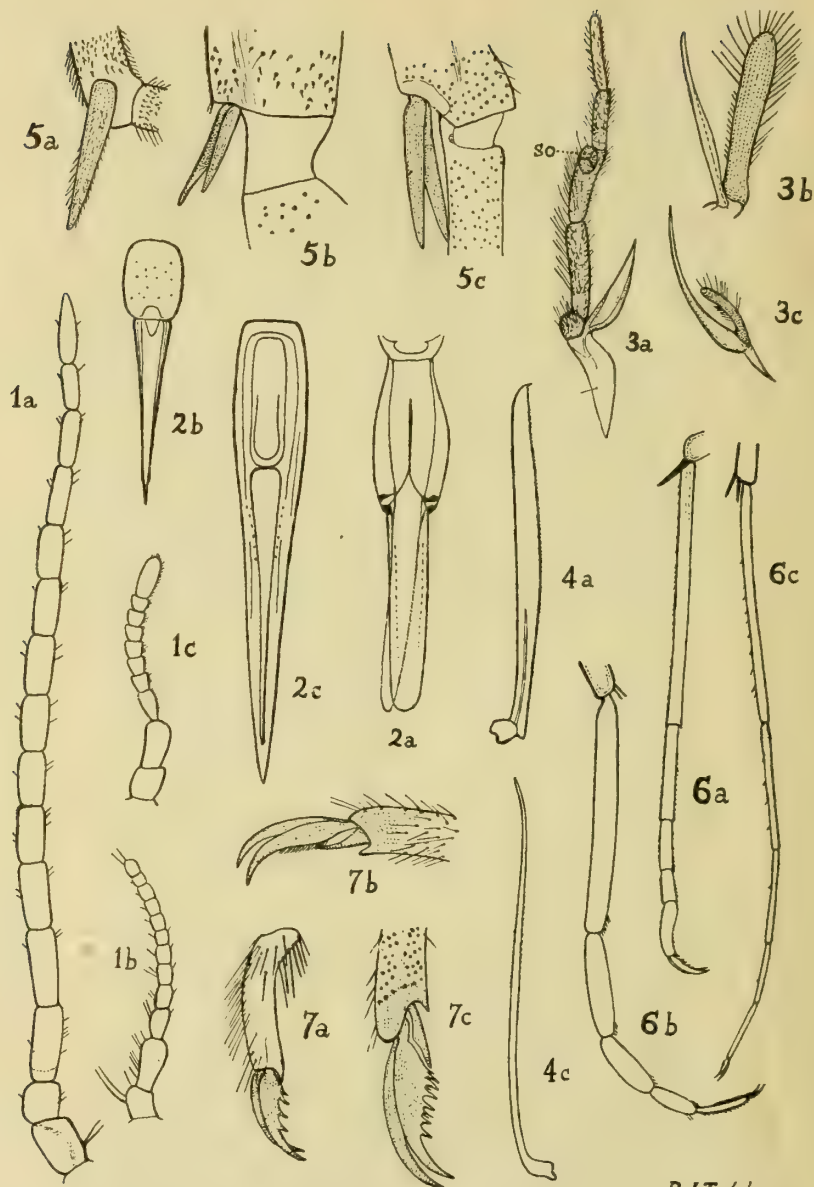


Fig. 1. *Edwardsina australiensis* n.sp., ♂, (x $2\frac{1}{4}$).
 Fig. 2. *Edwardsina australiensis* n.sp., ♀, (x $2\frac{1}{4}$).
 Fig. 3. *Neocurupira nicholsoni* n.sp., ♂, (x $2\frac{1}{4}$).
 Fig. 4. *Apistomyia tonnoiri* n.sp., ♂, (x $2\frac{1}{4}$).



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The suffix *a* indicates *Edwardsina australiensis* n.sp., *b*, *Neocurupira nicholsoni* n.sp., and *c*, *Apistomyia tonnoiri* n.sp.

Fig. 1. Antennae (x 50).

Fig. 2. Labrum-epipharynx with hypopharynx beneath (x 50).

Fig. 3. Maxillae (*a*, *b*, x 50; *c*, x 100); *so*, sense-organ on third segment of palp.

Fig. 4. Mandibles (x 50); those of *Neocurupira nicholsoni* n.sp. not figured.

Fig. 5. Tibial spurs of hind leg (*a*, x 50; *b*, *c*, x 100).

Fig. 6. Hind tarsi (x 20).

Fig. 7. Claws of hind tarsi (*a*, *b*, x 50; *c*, x 100).

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